Cranfield University

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Exploring and Describing Management Action for the Pursuit of Disruptive Innovation

School of Industrial and Manufacturing Science

PhD

Cranfield University

School of Industrial and Manufacturing Science

International Ecotechnology Research Centre

PhD Thesis

Academic Year 2004-2005

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October 2004

This thesis is submitted in partial fulfilment for the

Degree of Doctor of Philosophy

Abstract

Disruptive Innovation as a theory is often misunderstood and as a term it lacks clear definition. Moreover, there is an absence in existing research of a coherent framework to explain the qualitative factors that management practitioners face when attempting to pursue disruptive innovation as part of a balanced approach to innovation management.

In response to these problems, this thesis describes a researcher-led collaborative academic-industrial exploration of disruptive innovation. The research was conducted in three waves; first to generate an holistic appreciation of the organisational effort required in the pursuit of disruptive innovation; second to generate focus; third to explore a primary area of management action that constrains businesses to the pursuit of incrementalism. New qualitative knowledge was generated, based upon the experiences and insights of 127 industrialists from four case study organisations, 11 experts and the researcher's observations over a 33 month period.

Findings suggest that the theory of disruptive innovation fails to be translated into practice because managers lack an holistic appreciation of the innovation agenda. When this is the case, disruptive opportunities invoke management cognitions that drive disruptive innovation rejection strategies. In effect, managers allow their prevailing mental models to dictate an imbalanced focus upon steady-state, sustaining innovation. However, it was found that such inhibitors can be challenged by the use of adjusted portfolio management approaches. The research is primarily exploratory and provides the basis for a new, more grounded understanding of the pursuit of disruptive innovation in average performing organisations.

Acknowledgements

This research was supported by the Disrupti-it Project, a €3million, European Commission co-sponsored project for the Information Society Technologies Directorate, under the 5th Framework Program (conract ref. IST-2001-33372). I gratefully acknowledge the support, encouragement and the open minds of the European Commission's Paul Hearne and the panel of reviewers.

The last three years have been an adventure and a challenge that I could never have embarked on without the support of a multitude of people. I have so many people to thank.

Dr Fiona Lettice has been no less than an inspiration, her commitment and support knows no bounds; I have been lucky enough to have her as my Supervisor and friend and owe her a debt of gratitude. This research would have not been possible without the Disrupt-it Research Group. This was a fascinating gaggle of men and women from six different countries, with hugely diverse backgrounds, assorted experiences, with different religious and philosophical perspectives, owning divergent and changing priorities. What united us all was a healthy desire to learn about disruptive innovation, not to mention the amazing meeting locations, fantastic food, wonderful wine and a passion for post-it notes. I thank you all for your honesty, your integrity and for your bravery in collaborating with this adventure. Worthy of particular mention is Ron Dvir, whose patience and support was invaluable and did not go unnoticed, and Laura Vidal, whose energy and kindness will always be remembered. Gratitude is also sent to my expert interviewees. I would like to convey my thanks to Martin Wickes, Torsten Herzberg, Carol Webb, Annette Leslie, Karen Young and Atai Ziv from the FLG for their sharp minds and challenging questions, Louise Buckley for her sanity and Professor Steve Evans for his feedback and support in the closing weeks of writing this thesis.

This research has been a part of my life and the life of my friends and family for the last three years. I'd like to thank them all for their patience and understanding. In particular, I thank my Mum for her insights, Ed for his contemplations, Ricky for his pep talks, my sister B' for her last minute care-taking and last but by no means least, I thank my partner Kim, who probably doesn't quite realise just how much she has helped me; she is my balance and my guide, I am truly lucky.

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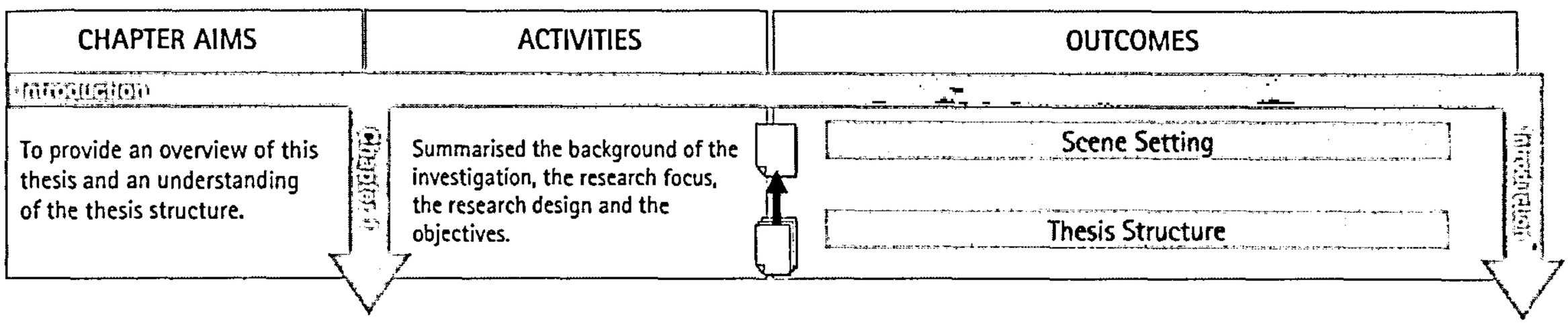
Contents

Chapter 5:

1. Introduction

The purpose of this chapter is to provide a background and context to the research presented in this thesis. The chapter first introduces the emergent and growing need for a focus of attention upon the topic of disruptive innovation, highlighting the gaps in knowledge that became the focus of the investigation, and detailing the resultant research objectives. The methodology chosen to address the research objectives is outlined and a clear distinction is made as to what the thesis aims to achieve. The chapter closes with an overview of the thesis structure.



1.1 Background

It is well recognised that periods of evolutionary change get punctuated by revolutionary transitions (Tushman and Anderson, 1986; Utterback, 1994; Schumpeter, 1975; Rogers, 1995). Technological and business model discontinuities that ignite new industries or change the rules of existing markets are not a new phenomenon; history is scattered with examples of major upheaval delivered because of technological, scientific or market shifts (Brockman, 2000; Kuhn, 1970; Tushman and O'Reilly, 1997). However, the issue at hand is that today's corporate leaders face the very factors that trigger these discontinuities at a rapidly increasing pace, and they find themselves increasingly threatened by the very real possibility that what they are good at today may be their downfall tomorrow (Abernathy and Clark, 1985; Chandy and Tellis, 2000; Christensen, 1997; Christensen and Raynor, 2003; Hamel, 2000). Today's successful business models are made redundant at a greater pace than ever, replaced by new propositions that were previously inconceivable (Hamel, 2000; Foster and Kaplan, 2001).

In 1967, Knight reported that "As a result of the rapid advances being made in science and technology, innovation has become a key component in today's society... this world of ours is a new world, in which the unity of knowledge, the nature of human communities, the order of society, the order of ideas, the very notions of society and culture have changed and will not return to what they have been in the past" (p136-137). In September 2003, at Stanford, the Institute for the Study of Accelerating Change acknowledged the continuation of this trend: "The rate of technological change has become dizzying, and it's only getting faster" (Sterling, 2004:102). In these ever more turbulent and competitive environments the importance of innovation has never seemed so pertinent.

Corporate leadership, therefore, faces a paradox (Kaplan 1999). Managers have to respond to operational challenges and quarterly or yearly revenue targets, which mandate a stringent focus upon short term results. However, our increasingly discontinuous world necessitates the far-sighted identification of revolutionary opportunities that might help to ensure long-term survival and growth of the enterprise. To survive in this world, executive management teams must ensure that they are directing 'ambidextrous organisations' (Tushman and O'Reilly, 1996) a category of organisation to which only a handful of enterprises have entered (Tushman and O'Reilly, 1996; Christensen and Raynor, 2003). To compound the issue, the world of emerging market opportunities and the pursuit of breakthrough innovation is considered to be a large and risky place, littered with failure (Kaplan 1999; Ahuja and Lampert, 2001). This puts a premium on better understanding the nature of innovation that can punctuate periods of evolutionary change and the factors that will enable or inhibit industrialists' attempts to deal with this phenomenon proactively.

Organisational innovation effort is traditionally focused upon performance improvement in attributes most valued by the most demanding customers - those willing to pay higher prices. Thus, both incremental and radical innovations offer performance improvements within the dimensions and directions that *lead-customers* (McDonald et al, 2001) desire and expect (O'Connor and Rice, 2001; Rothwell, 1995; Christensen, 1997). Much of the world's research into the innovation agenda has focused upon these sustaining innovations - sustaining the traditional trajectories of development (Dosi, 1986). Research that has focused upon discontinuities that change this 'steady state' (Bessant and Francis, 2004), conventionally focuses upon discontinuities that offer revolutionary leaps forward in performance improvement, still in directions that lead-customers desire, but to extents that are not yet expected possible (Tushman and Anderson, 1986; Christensen, 1997; DeTienne and Koberg, 2002). These innovations are less understood, less technologically certain and therefore more financially risky; nonetheless Christensen (1997) argues

that these sorts of discontinuities are still sustaining innovations, as they are mostly delivered by cash rich industry leaders, thus maintaining technological trajectories and competitive status quo.

There is a form of discontinuity known as a disruptive innovation –a term first coined and then popularised by Harvard Business School's Clayton Christensen. A disruptive innovation is a discontinuity that changes the steady state but unlike the conventionally considered discontinuous innovations, it will change the rules of the game, disrupting the status quo and traditional trajectories of improvement (Christensen, 1997).

Disruptive innovations are characterised by processes, customer offerings (products/services) or business models that offer lower performance along traditional trajectories or new performance that has previously not been considered. As such, they are undervalued by traditional lead-customers, generating either sales or gross margins that are perceived as "low-end" by industry incumbents. However, disruptive innovations gain a foothold by introducing new types of performance criteria to over-looked or ignored niche markets. Through a period of exploitation, reinvestment and improvement, the value proposition offered by the innovation evolves, enabling it migrate into the mainstream. In doing so, they bring new propositions to existing markets and eventually redefine the paradigms and value propositions on which existing industries are based. This process is discussed and explained by Christensen (1997), DeTienne and Koberg (2002), Charitou and Markides (2003) and Christensen and Overdorf (2000). For example, Ryanair and easyJet pioneered the low-cost-no-frills airline industry in Europe and, by migrating into the frequent flyer markets, nearly all European air travel carriers are now trying to adopt or fight the low cost approach (Lettice and Smart, 2004).

The term disruptive innovation, its origins and a critique of Christensen's seminal approach are discussed in the literature review presented in the next chapter. The review found that in recent years disruptive innovation has become an increasingly prevalent theme within the innovation and new product development literature; however, the emergent nature of the topic means that there are gaps in both the theory and the knowledge of practice (see Chapter 2). This investigation accepts the assumption that the theory of disruptive innovation offers a valuable approach to a major form of discontinuous innovation, which could provide the premium of long term organisational survival and new wealth creation. However, it is the prevailing gaps in knowledge and the fact that this potential remains unexploited by management practitioners that provides the motivation underpinning this thesis.

The likes of Schumpeter (1976), Tushman and Anderson (1986), and Carroll (1995) illustrate an historical academic root to the theory of disruptive innovation, through references to 'creative destruction', 'competence-destroying discontinuities' and 'industrial population dynamics' respectively. This provides a strong basis for the theory, moreover, academics and industrialists are expressing the urgent and growing need for an improved understanding of disruptive innovation and how it can be delivered (Danneels, 2004). In sum, the topic, in relation to innovation research as a whole, is emergent and the interrelated, qualitative management issues remain under-researched and misunderstood.

1.2 Focus of the research

Chapter 2 shows that multiple perspectives have been used to describe the process of disruptive innovation. And that extant literature also identifies, in discrete locations, a diverse range of factors that could enable or disable an industrialists chances of successfully pursuing the phenomenon. However, at the onset of the research there were, among others, three important gaps in knowledge: (1) a clear definition was unavailable, (2) a coherent unified framework of enablers and inhibitors with direct relevance to the ability to foster disruptive innovation was not present, and (3) much of the research in the field involved leading edge organisations; discounting the experience of average performers and demonstrating a gap in academic knowledge and an even wider gulf in practitioner-understanding regarding the application of the theory.

Therefore, the research was focused upon the exploration of the pursuit of disruptive innovation (defined as building the capacity and capability to foster and exploit potentially disruptive opportunities), within average performing organisations. The lack of a clear definition of the term disruptive innovation, the quantitative focus within extant literature, and an insufficient understanding of the qualitative factors that enable or inhibit the pursuit of such innovations, emphasised the requirement for the development of a more *grounded understanding* (Glaser and Strauss, 1967). Such understanding could be achieved through the exploration of disruptive innovation from the perspective of those charged with its pursuit in industry. Thus, it is from this stance that the current research was conducted. The goal was not to create a complete picture or model of the pursuit of disruptive innovation, rather it was to expose and explore aspects of most relevance to those involved. Therefore, this research aims to generate new in-depth, context specific knowledge that can contribute to an enhanced understanding for future theory development.

It is hoped that this knowledge will enable both academics and industrialists to begin the extraction of real possibilities, from a better understanding of the qualitative issues involved in an average performing organisation's pursuit of potentially disruptive innovations.

1.3 Research Questions and Objectives

To address the three highlighted gaps in knowledge a primary research question was established, which also spawned three sub-questions. Following the observation of a gap in qualitative methodological research approaches in the field of disruptive innovation, a secondary research question was also established (Table 1-1).

Research Question 1:	What are the key facilitators and inhibitors that today's management practitioners face, within average performing (or non-best-practice) organisations, when attempting to enable a capacity and capability for disruptive innovation?	
	Sub-question 1:	Can the multifaceted and interrelated issues of the pursuit of disruptive innovation be explained in an holistic conceptual framework?
	Sub-question 2:	Can an holistic conceptual framework of disruptive innovation be used to discover important focus areas of management action or cognition that must be addressed 'today' by management practitioners who are initiating the pursuit of disruptive innovation?
	Sub-question 3:	Can a deeper understanding of important managerial focus areas, which are critical to the pursuit of disruptive innovation, be used to develop tools or approaches that can facilitate practitioners to tackle the key obstacles to their pursuit of disruptive strategies?
Research Question 2:	Can a collaborative academic-industrial approach, to exploring and describing the pursuit of disruptive innovation, facilitate both the development of academically rigorous new knowledge and the delivery of useable guidance for management practitioners?	

Table 1-1: Research Questions

In order to answer the first research question, a primary research objective was established with three sub-objectives; these were set alongside a secondary research objective established to address the second research question (Table 1-2).

Research Objective 1:	To explore the nature and experience of management practitioners' pursuit of potentially disruptive innovations in average performing (or non-best-practice) businesses.	
	Sub-Objective 1:	To deliver an holistic understanding of the key facilitators and inhibitors faced by management practitioners wanting to enable the capacity and capability to pursue potentially disruptive innovations within their non-best-in-class organisations. And to convert this knowledge into an holistic processual and systemic conceptual framework, grounded in both data and theory.
	Sub-Objective 2:	To explore the emergent conceptual framework in order to identify focus areas of management action and management cognition to which the delivery of potentially disruptive innovations are highly dependent.
	Sub-Objective 3:	To specify, design and implement a management intervention to probe a priority focus area of management action and cognition. The intervention should be able to build new academic knowledge, whilst simultaneously improving the ability of the participating organisations to pursue potentially disruptive innovations.
Research Objective 2:	To use this collaborative investigation as a tool to extend knowledge and practice of academic-practitioner methodological approaches in the field of innovation research.	

Table 1-2: Research objectives

1.4 A summary of the research design

The methodology designed for this investigation was driven by the research objectives. As the research is grounded in the real world, the research design was also grounded in a real world context within an academic-industrial research group. It was constructed in a series of three waves to provide increasing focus to the investigation. Thus, the researcher does not test existing theory, nor does he attempt to establish causal relationships or generate hypotheses; a phenomenological perspective is adopted for emergent knowledge development.

The aim of the first wave was to create a rich understanding of the complex web of conventions, rules, actions, behaviours and cognitions that contribute to enabling or inhibiting the pursuit of potentially disruptive innovations in today's organisations. This involved complete immersion into

the collaborative research group, consisting of industrialists from four case study organisations. In the second wave the researcher facilitated the industrialists to identify and explore key focus areas of managerial activity. A grounded approach (Glaser and Strauss, 1967) to data collection and analysis was deemed appropriate for both waves of the research. Predominantly inductive thinking and analysis resulted in the discovery of three key findings – an holistic conceptual framework of themes and constructs, four managerial focus areas and a prioritised focus area of management action and cognition.

The final wave of the research adopted an inductive-deductive approach. A management intervention was developed to probe the prioritised focus area of management action and cognition. A deep analysis and coding exercise (Strauss and Corbin, 1997) was used to appraise the data. In doing so the author was enabled to build, analyse and connect emergent themes into categories that formed three key findings; these took the form of constraining management actions and an understanding of the underpinning management cognitions, in terms of the identification of disruptive innovation rejection strategies and the intensity of their use.

The management intervention process proved in itself to produce significant industrial utility and is offered as another key finding. Furthermore, reflecting on the effectiveness of the research design enabled the identification of three techniques that enhance the use of the Mode 2, collaborative research approaches.

1.5 What this investigation is and is not designed to achieve: considering validity and reliability

If this investigation shed the phenomenological perspective and adopted the positivist approach, using quantitative methods in a search for generalisation to a broader population; then the researcher would adopt statistical measures to assess margins of error (Robson, 1993). Assessments of research grounded in these scientific traditions demand repeatability, generalisability and measures of statistical significance in order to assert rigour and worth.

The logical parallel with qualitative research is to discuss the issues of validity and reliability in order to clarify what the investigation will and will not achieve. An appraisal of this study in terms of the traditional positivistic view of these terms reveals why research from the qualitative domain has received unwarranted criticism:

- **Generalisability:**

The aim of this thesis is to generate new insights into the qualitative management issues regarding the pursuit of disruptive innovation. This will be achieved through an empirically grounded, context specific, collaborative investigation and is, therefore, not aiming for generalisability. Instead, it is hoped that it will contribute a meaningful starting point for the continuation of qualitative investigations.

- Validity:

Silverman (2000) asserts that it is almost impossible to objectively assess the true validity of qualitative data due to its deep, rich and complex nature. Along with French and Bell (1990) he states that qualitative research is valid and reliable when it is held as credible and valuable by people within the contexts that are under consideration.

This is a brief presentation of an important discussion that enabled the author to assert what the investigation will and will not aim to achieve:

This investigation will not.... ✗

... attempt to validate or qualify the relevance of the theory of disruptive innovation

... consider the managerial reactions to disruptive threats or the impact of regulations that predicate the needs for disruptive change

... explore all the comments of all the participants to the same degree

... produce findings that are applicable to statistical analysis

... be able to produce objective facts or truths

... claim generality to organisations outside the research group

... provide all the answers to the prevailing gaps in knowledge

This investigation will... ✓

... focus upon profit seeking organisations and their pursuit of disruptive innovation

... enhance understanding of the pursuit of disruptive innovation using a collaborative academic-industrial approach

... iteratively develop focus towards those elements of the pursuit of disruptive innovation that are most pertinent to the industrialists involved

... provide insights that can be tested or probed in additional studies

... enfold the perspectives of 'experts' external to the research programme and from the extant literature to reduce the potential for bias towards any data set

... focus upon facilitating the emergence of academically robust and industrially relevant understanding

... be a relevant and meaningful starting point for the continuation of qualitative investigations into industrialists' pursuit of potentially disruptive innovations

1.6 Key Deliverables

It is the belief of the author that the attempts to satisfy the above research objectives, as demonstrated in this thesis, has generated a lucid contribution to knowledge on the topic of disruptive innovation. The thesis will present four primary deliverables (Table 1-3):

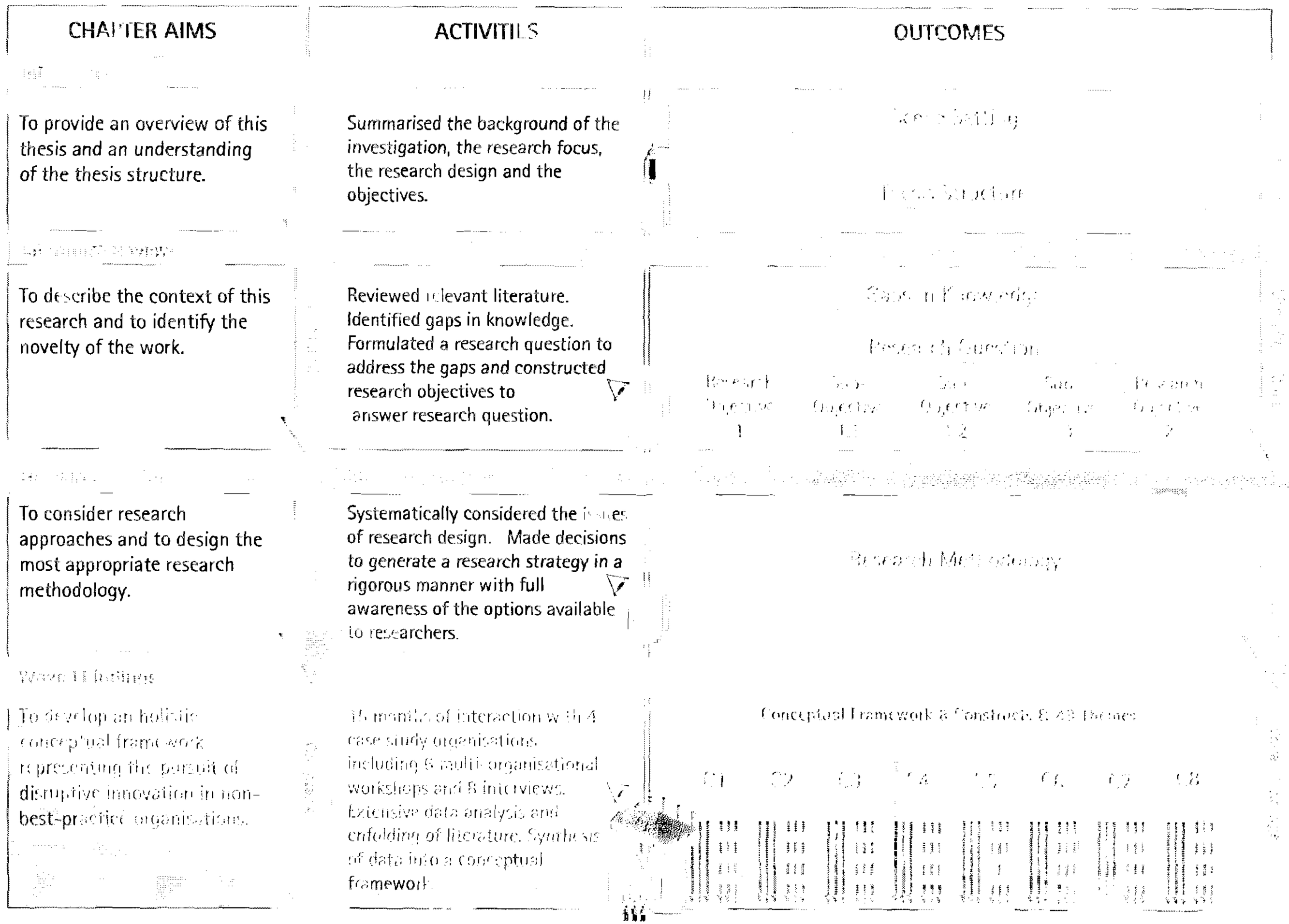
D 1:	An holistic conceptual framework of the facilitators and inhibitors involved in the pursuit of potentially disruptive innovations, resulting in a contribution to extant theory.
D 2:	The identification and description of a primary area of management action and cognition to which the pursuit of potentially disruptive innovations in non-best-practice organisations is highly dependent.
D 3:	A methodology for a management intervention that targets the primary area of management action and cognition in order to facilitate the pursuit of potentially disruptive innovations.
D 4:	A contribution to methodological strategies that pursue a collaborative research approach.

Table 1-3: Research deliverables

1.7 Thesis Structure

Figure 1-1 below provides an overview (split across two pages) of the thesis structure.

Figure 1-1: An overview of the thesis structure



CHAPTER AIMS	ACTIVITIES	OUTCOMES
To identify focus areas for management practitioners wishing to pursue disruptive innovation and to develop focus for the third wave of the research.	Design and implement third wave of research, using conceptual framework as a tool to analyse the four case studies. Identified focus areas. Validated focus areas with literature and expert interviews. Selected one focus area for Wave III.	Focus Areas Ranked Most Important by Participants Focus Area 1 Focus Area 2 Focus Area 3 Identified research focus for remainder of investigation
To develop and implement a management intervention that will provide a critical insight into selected focus area.	Developed management intervention to probe selected focus area. Implemented intervention in two cases. Collected observations from before, during and after intervention.	Design and implement a management intervention Observations: Implementation #1 Observations: Implementation #2
To generate new knowledge by exploring the outcomes of the investigation and discussing them in the context of the literature and practice	Meta-triangulation of data to identify deeper underlying reasons for a failure to foster disruptive innovation. Summarise outcomes into key findings	Identified disruptive innovation properties
To ensure the research objectives have been met, to summarise the contribution to knowledge and to recommend future research directions	Reflect upon research activities and outcomes to ensure satisfaction of research objectives. Synthesis of key findings into contribution to knowledge. Reflect upon investigation and literature to highlight future research directions.	Objective 1 Objective 2 Objective 3 Objective 4 Objective 5 Contribution to knowledge Recommendations for future research

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2. Literature Review

This chapter describes the context of the research. By reviewing extant literature it identifies the novelty of the work, and positions its contribution by demonstrating the gaps in knowledge that are addressed.

CHAPTER AIMS	ACTIVITIES	OUTCOMES
To describe the context of this research and to identify the novelty of the work.	Reviewed relevant literature. Identified gaps in knowledge. Formulated a research question to address the gaps and constructed research objectives to answer research question.	

"If new entrants can capture billions of dollars of new wealth in an industry without the resources and accumulated experience of an established player, imagine the possibilities if the energy and resources of an already successful company could be focused on the challenge of inventing new opportunities for new wealth creation" (Hamel, 2000:288).

2.1 Introduction and purpose of this chapter

A literature review was conducted at the outset of this investigation; its purpose was to clarify the definition of the term disruptive innovation and to identify gaps in knowledge to provide research questions. In doing so, a high-level understanding of the field was achieved and research objectives were established. As the research methodology was inductive the majority of the reading and synthesis occurred during the research activities themselves, thus literature will be introduced in chapters 4, 5, 6, and 7, along with the appropriate results and discussion. The purpose of this literature review, therefore, is to introduce the topic of disruptive innovation and to identify the novelty of the work, and to position its contribution by demonstrating the gaps in knowledge that this thesis will address. Given time and space limitations, the review cannot recreate all the debates of the past; instead, an overview is provided. The term disruptive innovation is introduced by summarising its historical roots and demonstrating its position in the field of innovation literature. The theory of disruptive innovation is then described from the writings of its main proponent and a critique is offered; this demonstrates the multitude of possible

research areas. Finally, focus is brought to the specific gaps in knowledge that inspired the research objectives of this thesis.

2.2 Defining innovation and innovation management

There is much debate about the definition and boundaries of the term 'innovation' (see Adams (2003), Trott (1998) or Tidd et al. (1997) for a full discussion). In its broadest sense, this phrase refers to the creation and implementation of a novel idea, relative to a social context, with the purpose of delivering benefit. Tidd et al, (1997) offer a definition that summarises this breadth: "... innovation is often confused with invention but the latter is only the first step in a long process of bringing a good idea to widespread and effective use" (p24). Although the topic of innovation is important to almost every sector of life from Government policy, to charities, non-profit organisations, schools, and the sciences, the focus in this thesis is the study of a particular kind of innovation within profit-seeking organisations.

A profit-seeking organisation's survival and success is based upon three abilities (1) to identify and satisfy some market demands or needs, (2) to develop competitive advantage over other firms seeking to offer products/services to these same markets and (3) to establish internal processes to ensure that the first two objectives are consistently met (Ansoff, 1965; Porter, 1980; Galbraith, 2004). It is generally accepted that the term innovation in this context equates to the process of theoretical conception, technical invention, and commercial exploitation of new ideas (Trott, 1998:12); effectively, all those scientific, technical, commercial and financial steps necessary for the *successful* invention, development and marketing of new or improved products, services or processes (OECD, 1981). As such, innovation is critical to organisational survival and success. In accordance with this understanding of the term innovation and statements from the European Institute of Technology and Innovation Management (EITIM, 2004), this study defines the term 'innovation management' as: the actions taken to effectively identify, select, acquire, develop, exploit and protect the technologies, products, processes business models and infrastructure needed to achieve, maintain and grow a market position and business performance in accordance with the company's objectives

2.3 A dualistic typology of innovation

Discussions stimulated by the dynamics of a Schumpeterian perspective (Schumpeter, 1975) of competition have stimulated the accepted proposition of a dualistic typology of organisational change, although this has been given many names, for example:

- persistence vs. change (March, 1981);
- evolutionary vs. revolutionary change (Nelson and Winter, 1982);
- incremental convergence vs. radical reorientation (Tushman and Romanelli, 1985);
- frame-bending vs. frame-breaking change (Tushman, Newman and Romanelli, 1986);
- incremental vs. radical innovation (Dewar and Dutton, 1986);
- continuous vs. discontinuous change (Tushman and Anderson, 1986);
- routine vs. non-routine, discontinuous change (Mezias and Glynn, 1993);
- sustaining vs. disruptive innovation (Christensen, 1997);
- linear customer offering innovation vs. non-linear business concept innovation (Hamel, 2000).

The consensus amongst these authors is that industries undergo long periods of convergence and continuous, incremental change or refinement, where organisations build upon existing know-how and competences. Conversely, these periods are occasionally punctuated by short bursts of change considered to be discontinuous and radical in nature; where frames of reference are broken, and underlying skills, technologies or competencies are rendered obsolete with the emergence of a new dominant paradigm of customer offering ("offerings constituted by physical goods and/or services" (Danneels, 2004:249)).

Foster (1985) was a pioneer of the use of technology S-curves to explain the differences between incremental and radical technological change; where an S-curve graphically represents technical performance change as a function of time (Tushman and O'Reilly (1997) note that S-curves can be plotted for all industries although their shape and size is influenced by scientific knowledge, market demand, and levels of investment and commercialisation). S-curves illustrate that inevitable technological maturity results in organisations facing diminishing returns on investment into incremental innovations, as substantial improvements in performance become increasingly difficult due to economic or technical constraints. The result is, technologies whether at a component or architectural level, that reach the maturity phase of their S-curves can become vulnerable to radically different classes of customer offering (Christensen, 1992a; 1992b), which can be represented by the emergence of new S-curves. When such a new class of offering has the

potential to compete on performance with existing offerings, and investments into their incremental improvement reap higher returns on investment, discontinuous change can occur. Thus, the interaction of an S-curve representing a mature technology with one that represents a new offering in its growth phase, illustrates the turbulent environment that is experienced within existing markets when frames of reference are broken, and underlying skills, technologies or competencies are rendered obsolete, as a new form of dominant design emerges (Foster, 1985; Tushman and O'Reilly, 1996, 1997, 2002; Utterback, 1994)[1].

Much of the literature in the field of innovation, new product development and organisational change has focused upon how to make organisations innovate more effectively (Mezias and Glynn, 1993). Given the relative infrequency of discontinuities in most industries, incremental innovations that improve and sustain current business paradigms are the most prevalently discussed and better understood within both industry and the literature (Mezias and Glynn, 1993; Leifer et al. 2000). Moreover, these incremental improvements are essential if management teams are to respond to operational challenges and quarterly or yearly revenue targets, which mandate a stringent focus upon short term results.

However, the subject of discontinuous change is receiving increasing attention because "... empirical studies have convincingly demonstrated a consistent, albeit disturbing, pattern of results with respect to the management of innovation. In almost every industry studied, a set of leading firms faced with a period of discontinuous change fails to maintain its industry's market leadership in the new technological era." (Paap and Katz, 2004:13). Dosi (1981) stated that it is new, small firms that rapidly emerge as key players in a sector when there is a "paradigm shift" in technology, which alters radically the rate, direction and skills associated with a technological trajectory. Moreover, Tushman and O'Reilly (1997) provide a review of this reoccurring theme and list diverse industries in which organisations have failed to manage such non-linear change, including, airlines, automobiles, cameras, colour televisions, optical equipment, hand tools, stereo equipment, radial tyres and watches. Placing yet more emphasis on this topic, is the Institute for the Study of

[1] While new technologies and business approaches are often central to what makes an innovation discontinuous or disruptive, it is acknowledged that forces such as a change in political regime, unthinkable events (such as war, natural disaster and terrorism) and Government policy can create spaces for radical change (e.g. Pilkington and Dyerson, (2002) discuss the auto industry in California). As stated in Chapter 1, such forces are not considered within the scope of this thesis, attention is given to profit seeking organisations and their pursuit of disruptive innovation.

Accelerating Change which, in September 2003, at Stanford, acknowledged "The rate of technological change has become dizzying, and it's only getting faster" (Sterling, 2004:102). In these ever more turbulent and competitive environments, where the life cycles of technologies and customer offerings are shortening, business leaders are looking for ways to achieve market leadership, and the importance of non-incremental innovation is escalating (Hamel, 2000; Deszca et al., 1999).

Tushman and Anderson (1986) proposed that discontinuous innovations are either 'competence-enhancing' or 'competence-destroying'. Competence-enhancing discontinuities "represent an order-of-magnitude improvement over prior products, yet build on existing know-how" (Tushman and Anderson, 1986:442), they are initiated by existing firms and are associated with little or even decreased environmental turbulence and reduced market uncertainty. However, competence destroying discontinuities, according to Tushman and Anderson (1986), are not only less well understood in academic literature, but because of factors including resource dependencies (Burgelman and Sayles, 1986) and path dependencies (Leonard, 1995), these innovations are synonymous with new market entrants. Whilst these competence-destroying, 'frame-breaking' innovations pose threats to some organisations they present opportunities to others: "Hewlett-Packard's inkjet printer platform, for example, represents a discontinuous innovation; this radical technology that displaced dot-matrix printing, helped create the desktop printer industry, and propelled the company into the leadership position of a multi-billion dollar market" (Kaplan, 1999:16). Thus, corporate leadership faces the paradoxical challenge of dualism (Kaplan 1999; Paap and Katz, 2004), functioning effectively today whilst innovating effectively for tomorrow, management teams must aim to direct 'ambidextrous organisations' (Tushman and O'Reilly, 1996, 2000).

In an attempt to address the challenges posed by the pursuit of creating the ambidextrous organisation, Christensen (1997) borrows heavily from the work of leading academics in the field of technology change, technological innovation and technological discontinuities, (for example Abernathy and Clarke, 1985; Dosi, 1982; Tushman and Anderson, 1986; Utterback, 1994). He presents a theory that divides all innovation efforts into two categories: 'sustaining innovations' and 'disruptive innovations'. Sustaining innovations are said to improve the performance of established technologies, processes, products, services or business models in an incremental, radical or even discontinuous nature "along the dimensions of performance that mainstream customers in major markets have historically valued" (Christensen, 1997:xv). He describes disruptive innovations,

as those that represent a new paradigm of customer offering, which generate new net wealth, whilst transforming or displacing some or all of an established market (Christensen and Rosenbloom, 1995; Christensen, 1997; Christensen and Overdorf, 2000; Christensen and Raynor, 2003).

Unlike other authors who have made similar distinctions, Christensen provides a detailed model to both describe and explain the forces that drive the emergence of disruptive innovations to punctuate long periods of evolutionary growth (Christensen, 1997, 2000; Bower and Christensen, 1995; Christensen and Bower, 1996). And his recent work continues to "teach companies how to use disruptive forces to their advantage" (McGinn, 2003:7). Another striking difference is that his theory has received unprecedented attention; Christensen's 1997 best selling book "The Innovator's Dilemma" has sold 500,000 copies in 10 languages (McGinn, 2003) and has provoked an insurgence of new high quality academic literature dedicated to the topic (Figure 2-1).

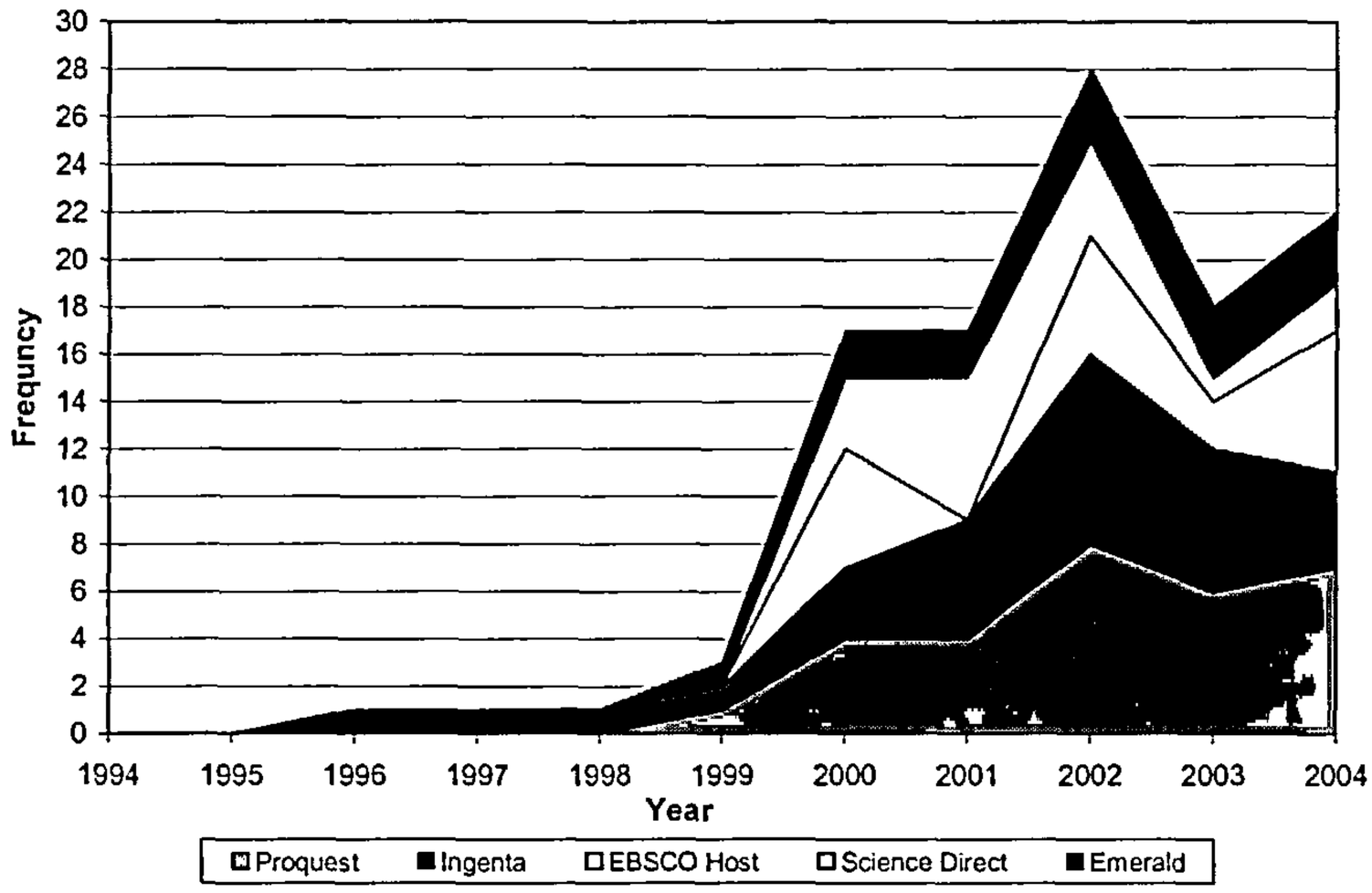


Figure 2-1: The Emergence of the term Disruptive Innovation in academic literature – The frequency of high-impact rated papers by year and on-line journal database (search criterion: phrase 'disruptive innovation' within 'article tile', 'abstract' or 'key words' – note: only half year data for 2004)

Christensen's work is reported to have helped generate breakthroughs in practice[2], and his work is considered to be possibly the most comprehensive explanation available of innovations that are able to break the status quo (Businesswire.com, 2000; Charitou and Markides, 2003). However, "...close reading of his book and the articles he has co-authored with his colleagues have left many questions unanswered." (Danneels, 2004:246). For all these reasons Christensen's theory warrants attention; the following sections provide an overview of Christensen's core model of disruptive innovation followed by a critique, to identify specific gaps in knowledge.

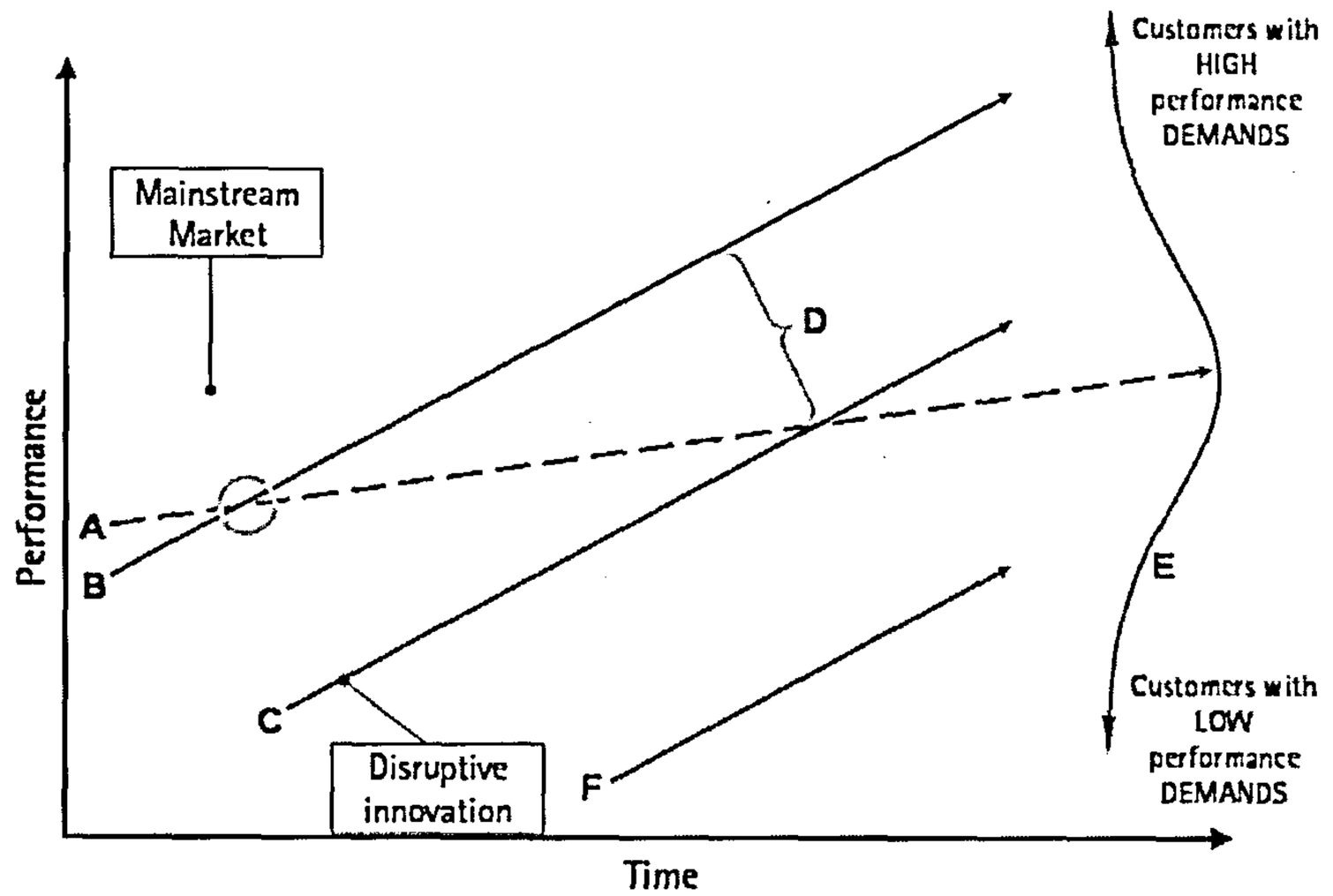
2.4 Christensen's theory of disruptive innovation

Christensen first coined the phrase 'disruptive technologies' with popular appeal in 1997 (Christensen, 1997; Bower and Christensen, 1997). He claimed that almost all the organisations that have 'died' or been displaced from their industries, because of a new paradigm of customer offering, could see the disruption coming but did nothing until it was too late. He states the primary reason for this mistake is that managers assess the new approaches or technologies and frame them as either deficient or as an unlikely threat. Christensen modified his use of the narrow term 'disruptive technologies' and has since also embraced the term 'disruptive innovation' (Christensen, et al. 2000; Christensen, et al. 2001; Christensen and Overdorf 2000; Christensen, 2003a, 2003b, Christensen and Raynor, 2003).

Christensen (1997) used Dosi's (1982) explanation of how new customer paradigms can be represented as discontinuities in trajectories of progress as defined within earlier paradigms - where a technological paradigm is a pattern of solutions for selected technological problems. In fact, new paradigms redefine the future meaning of progress and a new class of problems becomes the target of normal incremental innovation (Dosi, 1982). Therefore, disruptive innovations appear to typify a particular type of 'discontinuous innovation' (a term which, as noted earlier, has received more academic attention).

[2] Christensen and Anthony (2003) report that Intel Chairman, Andy Grove, attended a seminar at Harvard and went on to use disruptive innovation theory to inspire and pursue the creation of the Celeron microprocessor chip. Celeron has not only generated new net wealth, but has become their biggest selling product and has protected the business from new low-end entrants.

When considering examples of disruptive innovation, one should "... graph the trajectories of performance improvement demanded in the market versus the performance improvement supplied by technology... Such charts are the best method I know for identifying [and explaining] disruptive technologies" (Christensen, 2000:206). In doing so, it is possible to illustrate the dilemma faced by practitioners when their decisions to ignore technologies that do not appear to address their customers' needs become fatal when two paradigmatic trajectories of progress interact (Figure 2-2).



Key **A** = Performance that customers can absorb and utilise (mean performance demanded)

B = Performance trajectory of traditional technology driven by sustaining improvements

○ = Point of oversupply

C = New 'disruptive' performance trajectory

D = Significant oversupply by traditional technology creates a vacuum for new proposition

E = Normal distribution of customers by performance demanded

F = New 'potentially disruptive' performance trajectory

Figure 2-2: Intersecting trajectories of: performance demanded vs. performance supplied (adapted from Christensen 1997 and Christensen and Raynor, 2003)

Christensen's model of disruptive innovation is based on the premise that the performance demanded by customers within an existing market can be mapped onto a normal distribution curve, from low-demanding to high-demanding, and that average, mainstream customers will always demand and be able to absorb more performance over time (line 'A' in Figure 2-2). Moreover, it is

this tendency that inspires the drive for performance improvement provided within the technological paradigm that serves these customers (line 'B' in Figure 2-2). Competitive pressures in the market place will often force the performance improvement provided to take a different trajectory to that of performance improvement demanded or that can be absorbed by the customers (Hill and Jones (1998) refer to this trend in two ways – 'technology myopia' and simply the desire to 'keep up with ones neighbour'). When the trajectory slopes differ, and performance provided exceeds performance demanded (points 'O' and 'D' in Figure 2-2), new technologies and customer offerings that were only performance-competitive in remote market niches may migrate into other customer networks (note that line 'C' in Figure 2-2 gradually moves into the 'mainstream market'). This process provides innovators with a vehicle to new customers, who would have previously viewed their offerings as substandard. In fact, Christensen, Raynor and Verlinden (2001) state that the feature of performance oversupply literally creates a vacuum into which simpler, more convenient customer offerings are draw. This process enables new entrants to offer established mainstream markets a new set of performance value attributes that are now more relevant than those offered by the current paradigm.

Clear parallels can be drawn between the term disruptive innovation and Tushman and Anderson's (1986) competence-destroying discontinuities; both require new skills, abilities and knowledge, and are associated with increased environmental turbulence and increased market uncertainty. Furthermore, both have been described as usually delivering a new product class, a significant product substitute or a radical new way of making a product that changes the basis of competition between firms. Although, both claim new entrants almost always initiate these innovations, there is some disagreement between the authors: "We contest the conclusions of scholars such as Tushman and Anderson (1986), who have argued that incumbent firms are most threatened by attacking entrants when the innovation in question destroys, or does not build upon, the competence of the firm. We observe that established firms, though often at great cost, have led their industries in developing critical competence-destroying technologies, when the new technology was needed to meet existing customers demands" (Christensen and Bower, 1996:199). This clarifies that the difference between these terms can be found in the starting point of the technology or customer offering and its relationship with mainstream markets. If a competence-destroying discontinuity is applicable and desirable to mainstream customers who are voicing a demand, incumbent firms are more likely to pursue the technology or customer offering as an extension to their current business – adopting a discontinuous change within a sustaining innovation strategy. However, where there is an absence of this demand, and a demand from a

small remote customer niche, that is overlooked by the incumbents' prevailing customer offering, then there may be scope for a new entrant to adopt a disruptive approach with the introduction of this potentially 'game-changing innovation'.

To further enrich the model presented in Figure 2-2, Christensen uses the concepts of customer need and product attributes (Christensen, 2003a; Christensen and Raynor, 2003). The basis of a customer's choice between competing customer offerings is directly linked to the benefits they desire - their customer need. McDonald et al. (2001) state that customer offerings can be thought of as bundles of specific attribute sets offering differing levels of performance on varying dimensions – whereby it is the technology or intellectual property that is embedded in the customer offering, which is responsible for the said set of attributes. Different customers or market niches, will seek different benefits, which in turn drives a desire for different attributes sets (McGrath and Macmillan, 1995) and creates markets of companies responding with varied customer offerings based on customer need (McDonald et al., 2001). Thus, it is customer needs that determine which performance dimensions and attribute sets form the bases of competition. The technology and intellectual property of all customer offerings will have performance limits and constraints, which in turn limit the prevailing attribute sets to a distinct range of performance (Christensen and Raynor, 2003).

Christensen and Raynor, (2003) use the customer needs and product attribute perspective to explain the theory of disruptive innovation. They say that disruptive innovations are customer offerings based on technologies or processes that enable different attribute sets to those offered by the prevailing dominant offerings. These new offerings initially exhibit lower performance on dimensions that are specifically relevant to the mainstream market; however, they introduce higher performance on dimensions valued by remote or emerging market segments. It is therefore within these smaller, lower-revenue niches where they establish their commercial footing with relatively undemanding customers (Christensen, 1997, 2002; Bower and Christensen, 1995; businesswire.com, 2000; Christensen and Rosenbloom, 1995). Through the exploitation of the surrounding niche markets, it is possible to raise the investments required for product/service improvement. Eventually the performance levels proffered by the new offering meet or exceed the minimum levels demanded by the mainstream market. This initiates the process of disruption, allowing the previously ignored technologies or approaches to migrate into the mainstream with attribute sets that do not over supply customers' needs and additional features that the incumbent technological paradigm does not and often cannot contain (see Appendix 1 for descriptions of commonly cited examples of market/technology disruption, using Christensen's model).

Christensen's theory initially focused upon the migration upstream of 'low-end' disruptors; depicted in Figure 2-2 and described above as remote market niches. It was only after Gilbert (2002 and 2003) presented a differing model that Christensen broadened his theory to include emerging market niches. Gilbert (2002 and 2003) stated that managers could use 'new-market disruptive strategies' as well the low-end approach - where 'non-consumers' are offered a simple, convenient product or service that allows them to do things that they would not have other wise been able to do. The growth of the new market is ignored by established companies as it is considered too small and the technology "not up to snuff on the performance criteria that existing companies focus on" (Gilbert, 2003:8). However, much like the low-end disruptions described above, the incremental improvements of the customer offering allows the growth of the niche and eventually the attraction of customers from established markets and "...by the time incumbents begin to notice the defection, its too late." (Christensen and Anthony, 2003:2) the attribute set of the new entrant has permanently reshaped the existing market (Figure 2-3).

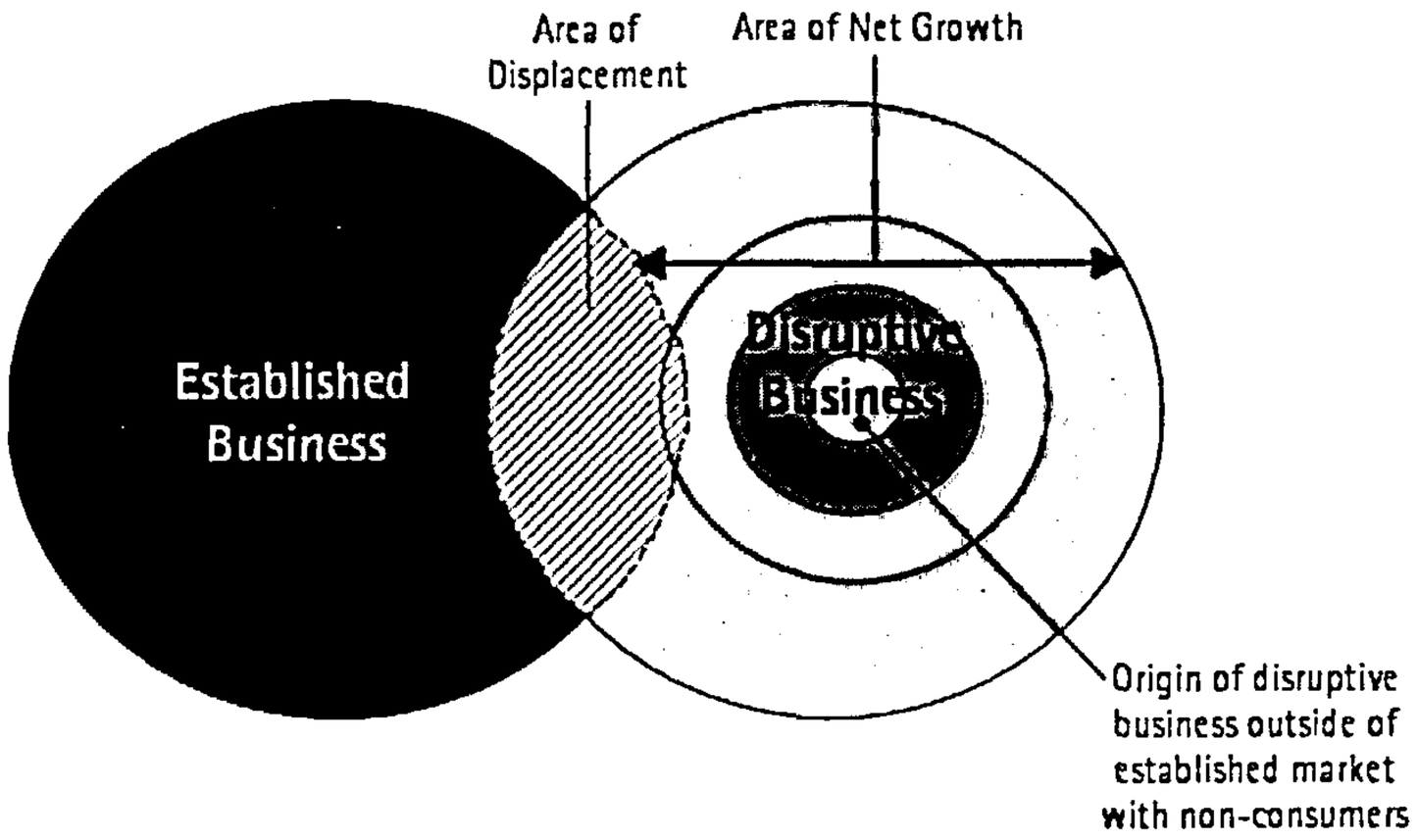


Figure 2-3: New- market disruption (adapted from Gilbert, 2002)

The theory of disruptive innovation highlights that the consequences of failing to secure non-incremental innovations can be more significant than lost opportunities or lost market share. Incumbent firms, that have failed to embrace new disruptive customer offerings before they deliver their disruptive effect, have been shown to suffer: financial losses, redundancy of staff, stock write off's, stock price reductions and corporate bankruptcy (Utterback, 1996; Barr, et al. 1992; Christensen, 1997; Tushman and Anderson, 1986; Hamel, 2000; Charitou and Markidies, 2003). In fact, disruptive innovation can signal the end of industries as we know them (Christensen, 1997;

Christensen, 2003b; Foster and Kaplan, 2001). The academic and industrial pertinence of this theory has inspired a new wealth of research into discontinuous innovation and more specifically, a succession of researchers to create disruptive innovation specific frameworks and approaches for

- anticipating disruptive innovations (e.g. most recently Paap and Katz, 2004);
- assessing the probability that a new entrant poses a disruptive threat (e.g. Raffi and Kampas, 2002);
- marketing strategies for disruptive innovation (e.g. Moore, 2000; Christensen and Raynor, 2003);
- identifying market niches for potentially disruptive innovations (Cooper et al 2001; Lynn et al., 1996);
- challenging prevailing business models to generate disruptive concepts (Allen et al, 1999; Hamel, 2000);
- exploring and communicating the relationships over time between evolving and developing markets, products and technologies (e.g. the use of technology roadmapping Phaal et al 2004);
- responses to disruptive threats (Gilbert and Bower, 2002 and Charitou and Markides, 2003)

It is the opinion of the author that the theory of disruptive innovation and the publications of its lead proponents offer glimpses into critical technological trends and the challenges that managers will face once they have mastered the 'basics' of innovation management. This different approach to innovation requires very different ways of dealing with the issues of innovation management and despite the comprehensive façade of Christensen's theory there are gaps and weaknesses that must be addressed.

2.5 A critique of disruptive innovation theory

Christensen offers a detailed technical description of the forces that facilitate the insurgence of a disruptive innovation (of which only a high level summary is provided above). He provides thorough case evidence and in his recent co-authored work he generates a deeper understanding of the managerial aspects of the theory.

Traditionally emphasis within the literature on innovation, which could be thought of as breakthrough or disruptive, focuses on describing the process or outcomes of discontinuous change.

However, this appears to be shifting: today it is increasingly viewed as an important and necessary to conduct research into increasing an organisation's innovative capacity[3] and innovative capability[4] with regards to discontinuous innovations (Leifer et al., 2000). To this regard Christensen has aimed to deliver academically insightful and industrially provocative research. However, it would appear that the hype surrounding the emergence of the topic disruptive innovation may have caused harm, with a plethora of business articles summarising his multifaceted insights in just a few sentences. "Christensen offers a really intricate picture of how firms react to technological shifts, and I believe that readers do not always do justice to the complexity of his argument. One can see from a search for disruptive innovation on the web how loosely the term has come to be used and how it has become separated from its theoretical basis" (Danneels, 2004:257). Moreover, Christensen fails to provide a succinct definition of the term 'disruptive technologies' and then seems to widen his theory to 'disruptive innovation' with little statistical or methodological justification. It is the author's opinion that these issues have been damaging to the scholarly and industrial understanding and acceptance of his theory, and criticisms do not end here. Therefore, it is the purpose of this section to offer a critique of Christensen's disruptive innovation theory. Weaknesses that cause confusion in both academia and in practice are highlighted, a definition of the term 'disruptive innovation' is offered, closing with a summary of the prevailing gaps in knowledge.

2.5.1 A typology of discontinuous innovations

Kassicieh et al. (2002) note that all disruptive innovations are discontinuous yet not all discontinuities are disruptive. For this reason the consideration of the term discontinuous innovation should be made. Veryzer (1998) offers a review of discontinuous new product development from the perspective of serial, staged development. Similarly to Christensen, he shows that the perceived value attributes of a product or service are critical to innovations with discontinuous potential. However, he makes the distinction between "product capability" (the benefits of products as perceived by customers and users), and "technological capability" (the

[3] Defined as the potential of a firm to generate innovative outputs (Trott, 1998).

[4] Also know as organisational innovativeness and defined by Rogers (1995) as the propensity of the firm to adopt innovative output.

degree to which the product involves expanding capabilities beyond existing organisational boundaries). Using this perspective he showed that organisations can deliver three types of discontinuity (Figure 2-4). He suggests that each form of discontinuity requires a different management approach, in line with the areas of commercial or technical uncertainty, although he does not provide extensive guidance for practitioners.

Christensen fails to offer such a clear, categorical distinction in his perspective of disruptive innovation; although he notes that disruption can be caused by technological changes (Christensen, 1997), new commercial approaches (Christensen and Raynor, 2003) or the fusion of both (Christensen and Raynor, 2003). It is granted that many of the discontinuities to which Veryzer (1998) refers may be sustaining in nature, yet the exploration of disruptive innovation with Veryzers' framework could lead to a more comprehensive categorisation of non-sustaining innovations and an improved understanding of the managerial implications.

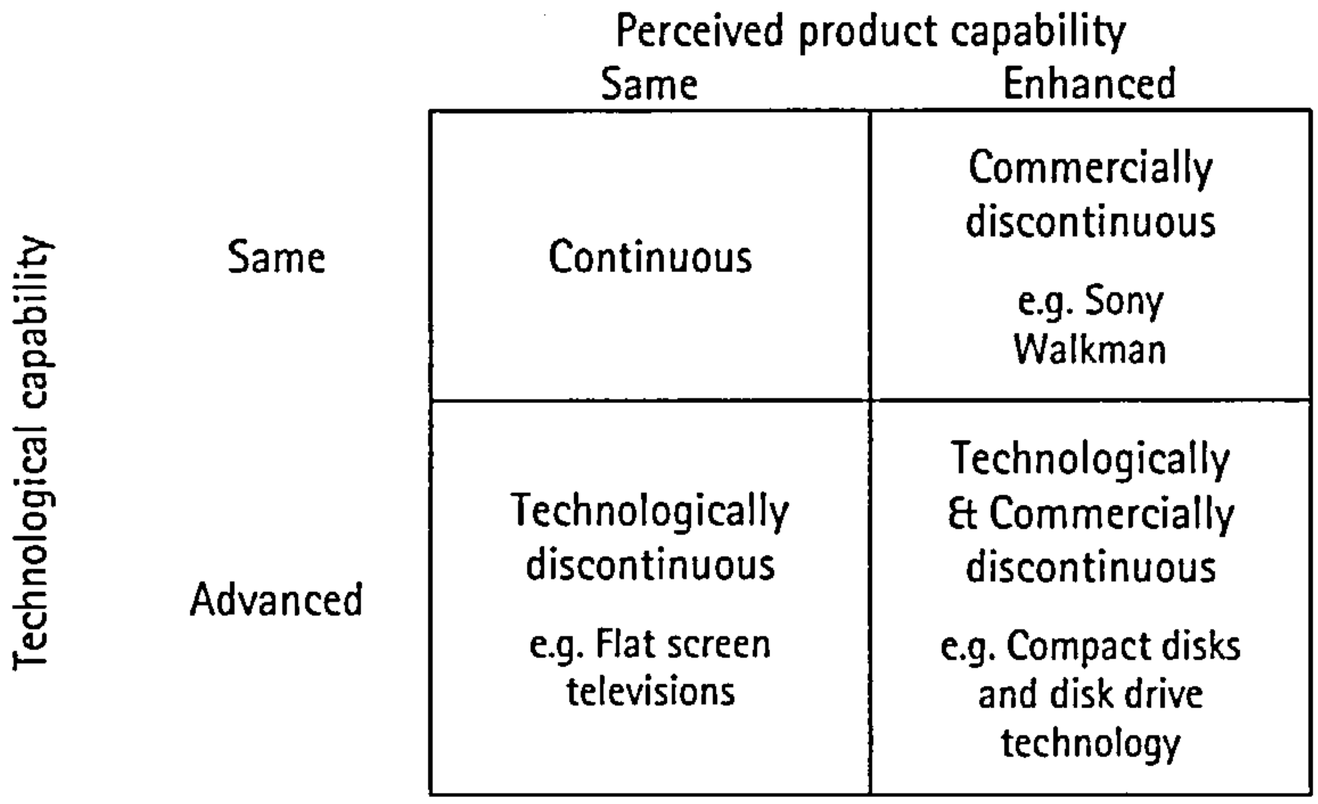


Figure 2-4: Types of discontinuous innovation (Veryzer, 1998)

Moreover, Veryzer (1998) mapped his findings to the traditional conception of staged new product development (NPD). He found the primary difference between the pursuit of discontinuous and continuous, incremental innovations is the need for extended periods 'dynamic drifting' (where technologists and business leaders need longer to explore the various linkages between markets, products and technologies) and more extensive efforts in prototyping and testing the specifications of new concepts with new niches of lead-users. In doing so, he was able to identify two critical areas of the traditional NPD process to which management teams can focus, if they intend to pursue discontinuities (Figure 2-5).

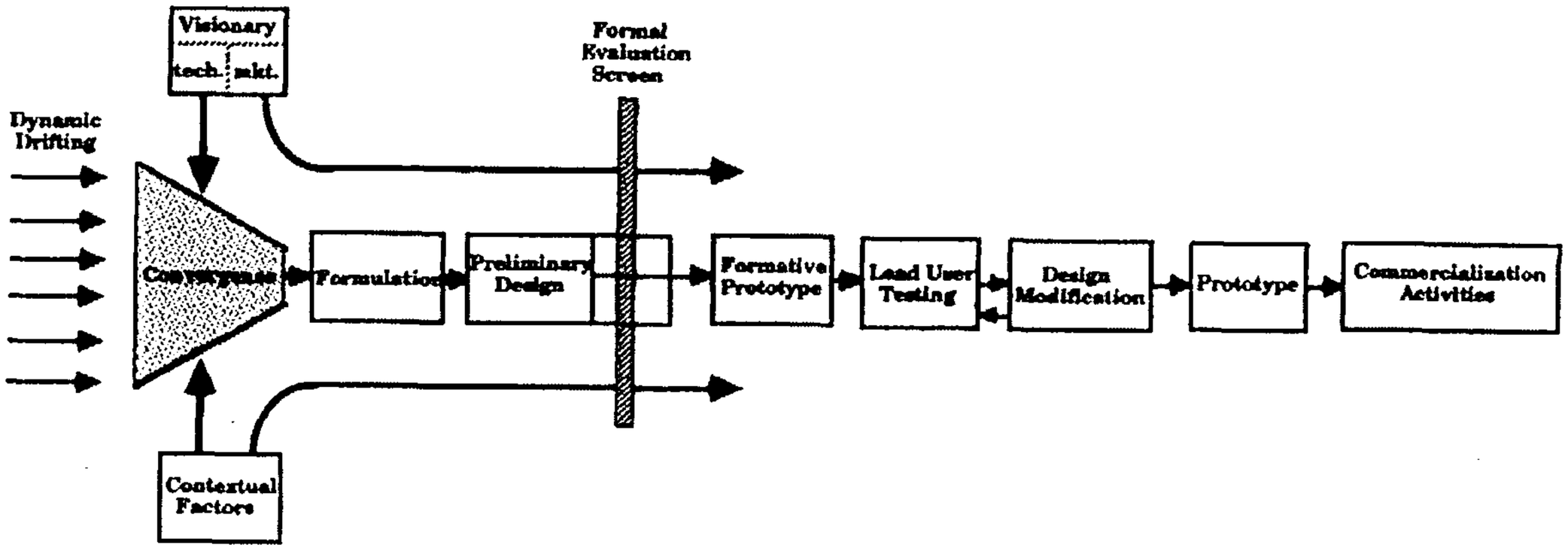


Figure 2-5: A new product development process for discontinuous customer offerings (Veryzer, 1998)

Although Christensen's work makes reference to these issues, they are not explored at length with direct reference to the traditional staged conception of NPD. Such an exploration would naturally force a deeper probing of both the management actions and cognitions that prove fruitful during these additional NPD functions and the specific changes in resource allocation, training, human resources etc. that the executive teams would need to initiate.

2.5.2 Business concept innovation

Hamel (2000) takes a business model perspective to the issue of dualism in innovation. He claims that management teams will be constrained to 'more of the same' innovation if their whole business concept remains unchanged or unchallenged. Alternatively, organisations can attempt to disrupt competitive paradigms with new technologies or customer offerings but the real economic value is only unlocked when the larger system is factored into the disruption and 'business concept innovation' is delivered. To do this, he claims an executive management team should attempt to 'unpack their existing business model'. By challenging, changing or re-inventing what appear to be its critical areas, an organisation can encourage non-linear system wide change and breakthrough business concept innovation (for example he credits the challenging of traditional business models in the airline industry for the emergence of the low-cost-no-frill approach).

Christensen's earlier work (e.g. Christensen 1997) attributed much of the process of disruption to new technological paradigms, failing to acknowledge at length the changes in the wider organisational system that are required to realise disruptive potential. His latter work (e.g.

Christensen and Overdorf, 2000; Christensen and Anthony, 2003; Christensen and Raynor, 2003) pays more respect to the importance of the required business model changes, although he has yet to provide a specific discussion of business concept innovation or the stresses and strains of business model change.

2.5.3 Population dynamics & resource partitioning

The 'ecological perspective' (Hannan and Freeman, 1984) is a less immediately pragmatic but equally insightful approach that has also been used to explain the dynamics of discontinuous change (Mezias and Glynn, 1993). Markets analysed include the US newspaper industry (Carroll, 1985), early telephone companies in the de-regulated US telephone markets (Barnett and Carroll, 1987 and Barnett, 1991), digital imaging (Mitchell, 1994), banking co-operatives (Baum and Singh, 1994) and the microprocessor industry (Wade, 1995, 1996). The notion is based upon considering changing competitive environments through the population of organisations within industries: the concentration of large generalist firms, the prevalence of smaller specialists, and the resource partitioning (Carroll, 1985) that occurs as a result. For example, within an industry population, large generalists compete with each other to occupy the centre of the market. "As economies of scale become important, dominant communities will tend to cater to the center of the market because they can reap the greatest cost savings by selling to the niche with the greatest number of customers" (Wade 1996:1241). This competition for similar resources and customers, frees peripheral resources to be exploited by new strategically specialised organisations, which sponsor new architectures, to which "the center of the market is less important ... because they do not have the capacity to take full advantage of economies of scale" (Wade 1996:1241). As dominant technologies mature, the concentration of generalists increases and "... opens up more pockets of resources into which specialists, especially those with new approaches, can enter and thrive... Paradoxically, then, the emergence of a dominant design may bring with it the seeds of its possible destruction." (Wade 1996:1241). This process gives rise to organisations with niche producer or distributor propositions that can eventually grow from their specialised position and new architecture (which the generalists struggle to offer) to enter the mature markets and create discontinuous change.

It could be argued that the extensive, quantitative, empirical base of evidence upon which the notions of industry population dynamics (Hannan and Freeman, 1984; Wade, 1996) and resource partitioning (Carroll, 1985; Wade, 1996) are based, appear to be much more congruent to the

concept of generalisability that the case based work of Christensen. This observation reveals methodological gaps in Christensen's research approach; these will be discussed later in this chapter. Alternatively, it could be argued that the process of disruptive innovation, as described by Christensen, adds richness to the perspective of industry population dynamics and the impact of resource partitioning. Despite Christensen's failure to discuss either, the amalgamation of these insights could surely generate a yet more comprehensive understanding of the dynamics and the emergence of disruptive change.

2.5.4 An holistic conception of disruptive innovation.

It is the holistic management models in the field of sustaining innovation, especially those that offer insights into qualitative management issues, that are often credited with effectively addressing the barriers to sustaining innovation and helping management practitioners to know where to focus their attention (Cooper, et al. 2001). Deszca et al. (1999) propose that breakthrough products can be developed by using the framework presented in Figure 2-6 and contend that focus should be given to continuous market assessment throughout.

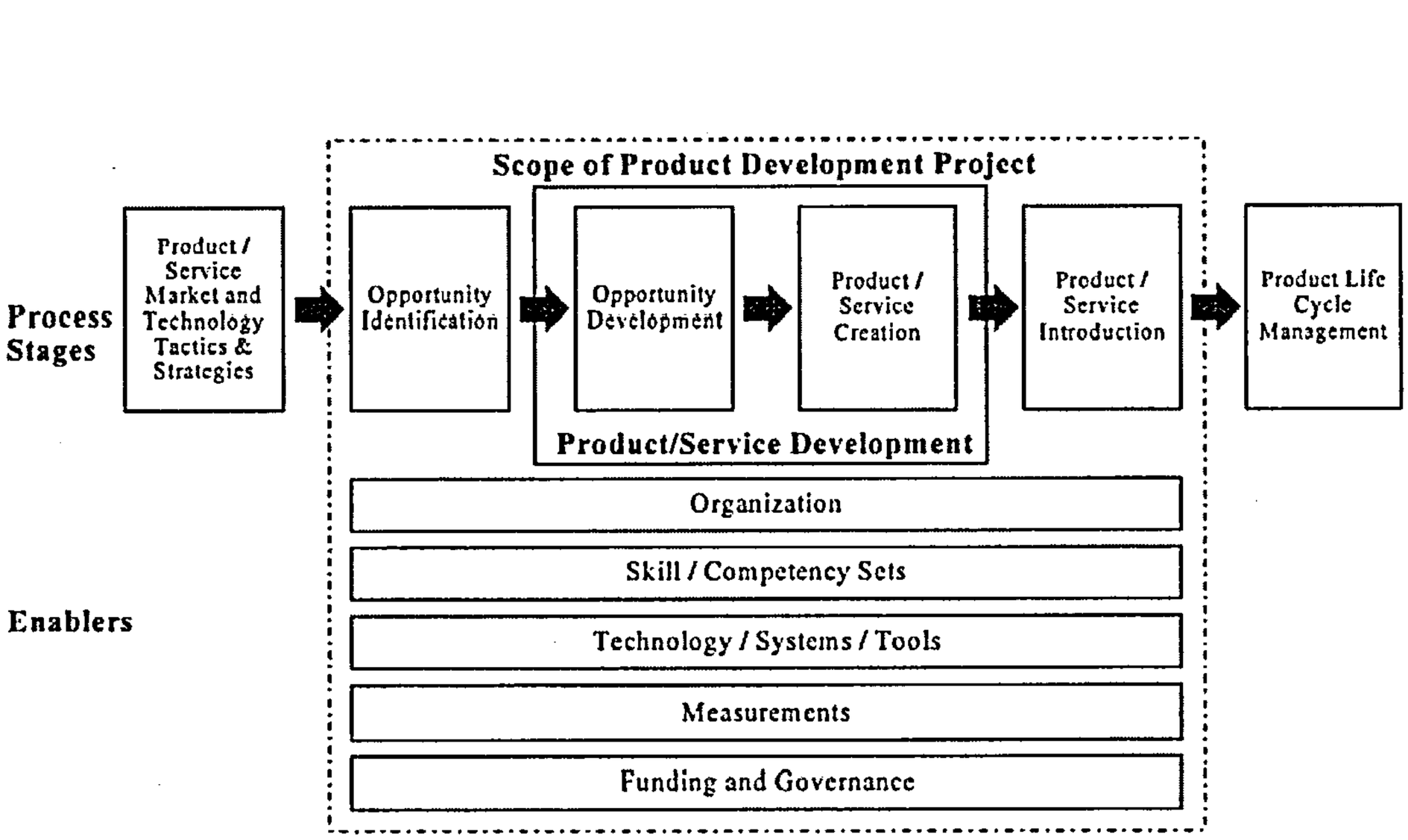


Figure 2-6: The New Product Development Framework. For Breakthrough Innovation (Deszca et al. 1999)

They concede that prevailing methodologies for assessing and incorporating the unarticulated needs of future customers into the development process are necessary but remain, as of yet, not entirely dependable; nonetheless they understand the power of creating an holistic framework to explain their findings. Christensen provides a detailed picture of the process of disruptive innovation; yet he has not offered such an holistic conceptual framework to illustrate his theory. This inhibits his attempts to provide his academic and industrial readers both an holistic appreciation of the topic and of the managerial implications.

Appendix 1 (1c) compares and contrasts three pertinent holistic approaches to innovation management from the field of sustaining innovation (Cooper's (1979, 1980, 1983, 1988, 1990) Stage Gate approach; Goffin and Pfeiffer's (2000) Pentathlon Model and Adam's (2003) critical review of innovation management), the results of this analysis offers strong parallels with Kanters (1988) conclusion that: "... the understanding of innovation benefits from examining structural and social facilitators as they wax and wane with the innovation development process. This requires a dynamic model, a combination of a "variance" model of the factors influencing innovation and a "process" model showing how innovation unfolds" (p172). There is an absence in the literature of an explicit holistic management model for the pursuit of disruptive innovations, which includes variance and process factors. Therefore, it is necessary to qualify a framework by which profit-seeking organisations can be understood holistically and then to assess how current literature addresses this space.

There are two dominant schools of thought that seek to explain inter-firm differences: the resource based view and the process or routine based view. An organisation's resources are generally features that can be bought, sold, depreciated or built; this would include its people and its assets (Ansoff, 1965) such as equipment, technology, brands, money, patents, relationships (Johnson and Scholes, 1999). Barney (1986, 1991, and 2001) is a key proponent of the resource based view of the organisation, noting that competitive advantage is mostly delivered by the ownership of superior management, better technologies, stronger brands and more effective relationships. One the key reasons he cites for most failed business ventures is that of an inadequate resource – the right manager for the job.

Alternatively, Nelson and Winter, (1982) explore at length the notion of routines (or processes) as the fundamental building blocks of competitive advantage. Johnson and Scholes (1999) note that critical organisational routines include: the processes for resource allocation, new product development, market research, budgeting, staff development and staff compensation. Routines and processes are the means by which value is extracted from resources (Ansoff, 1965); the process or routine based view asserts that competitive advantage is built, along with superior organisational capability, by developing better routines than competitors (Nelson and Winter, 1982). Moreover, supporters of this view state that superior routines can only be developed through a committed to the reproduction of effective behaviours.

As stated, resources and processes are not independent of one another. Therefore, to take a purely resource or process based perspective of the firm is to not see the hole picture (Christensen and Raynor, 2003). Moreover, Christensen and Raynor (2003) note that it is through the values of an organisations and its people that judgements are made regarding the application of processes to convert resources into business benefits. They state that values can be ethical or guiding principles - the standards by which employees make day-to-day prioritisation decisions. Therefore, whilst resources and processes hold an organisation's potential, it is in organisational values where constraints can be observed (Leonard, 1995) and an organisation's uniqueness understood.

Hamel (2000) reports that a product or service will only succeed in the market place with an appropriate and supportive business model - a design for the operations of a business which focuses on how revenue will be generated. Business models can be configured with the appropriate tension between organisational resources, processes and values. Therefore, in seeking to understand an organisation and to explain inter-firm differences the perspectives of resources, processes, managerial values and business models can be used to generate an holistic understanding. Moreover, another method of describing an organisation or explaining inter-firm differences is through consideration of the population of organisations within an industry - the 'ecological perspective' (Carroll, 1985; Hannan and Freeman, 1984). This too can be used to explain the differing approaches to managerial and business behaviour.

This analysis of the differing theoretical perspectives of the term organisation allows the formation of a framework by which the term disruptive innovation and extant literature on the topic can be considered (Figure 2-7 and 2-8).

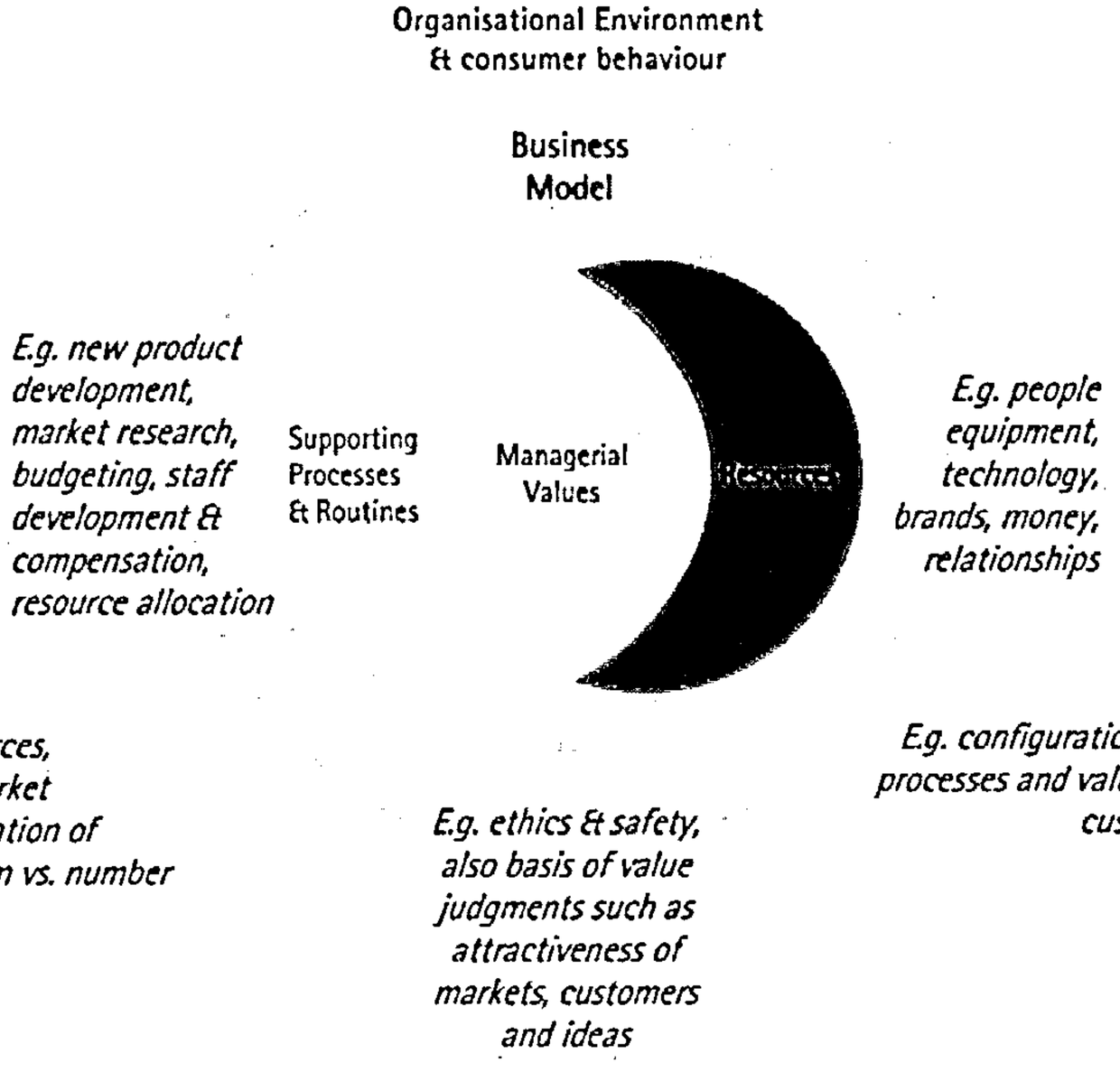


Figure 2-7: The perspectives of organisations

When mapping the literature on disruptive and discontinuous innovation onto this framework, it is revealed that authors report their findings from each of the major perspectives of an organisation. Christensen contributes findings to each of these views, but fails to provide an holistic conceptual framework that describes the qualitative factors that management practitioners face in the pursuit of potentially disruptive innovations.

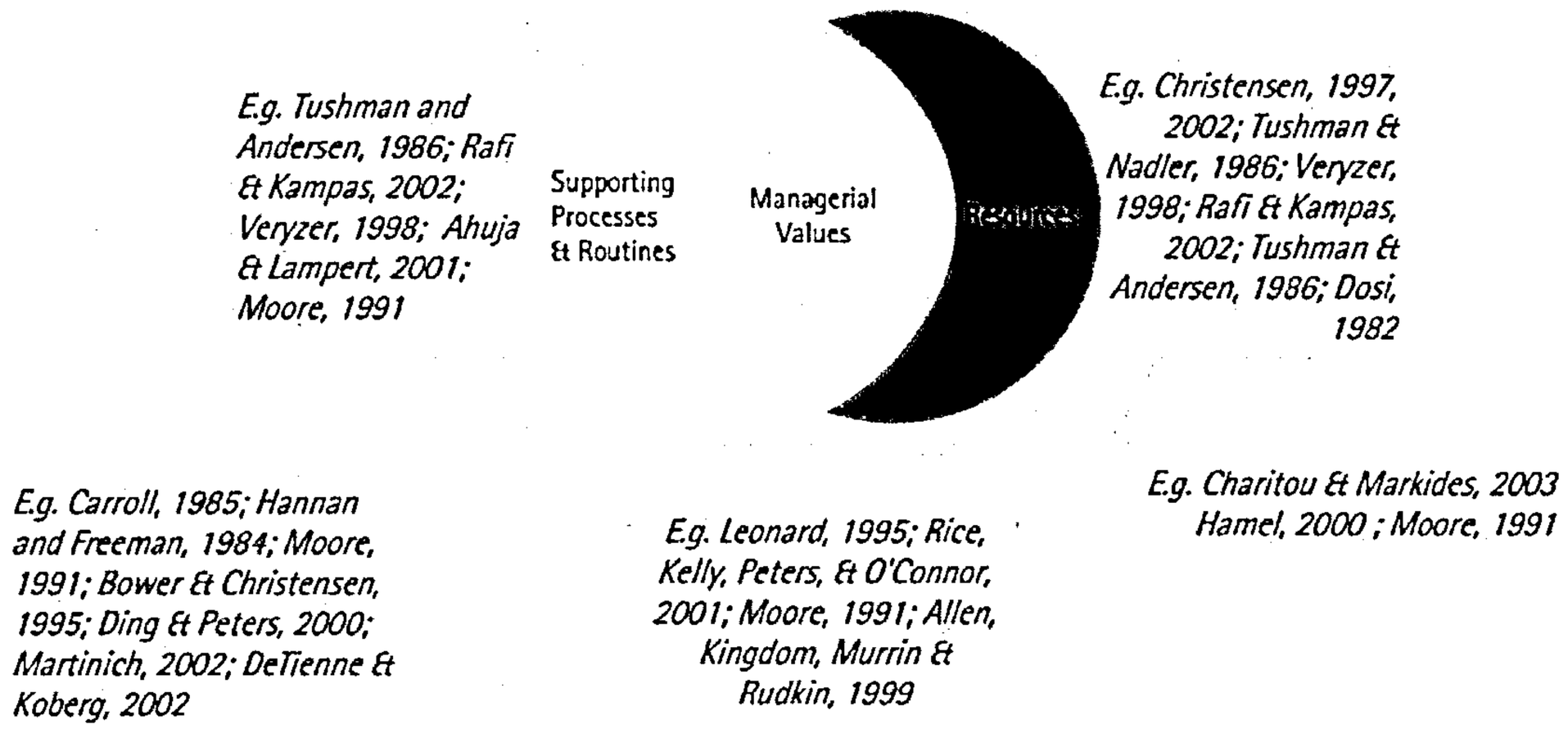


Figure 2-8: Disruptive innovation literature categorised by the perspectives of organisations

2.5.5 The function of perspective and location

Danneels (2004) raises one of the most regularly observed criticisms of Christensen's theory, he states that "the most essential question concerns what a disruptive technology [or innovation] actually is. If disruptive technologies [and innovations] pose a threat to industry incumbents and an opportunity to entrants, managers and scholars need to be able to distinguish disruptive from sustaining technology [or innovation]. What makes a technology [or innovation] disruptive? What are the exact criteria for identifying a disruptive technology [or innovation]?" (p247).

This question is frequently asked because of a number of difficulties in translating the theory of disruptive innovation and as a result of a number of gaps in understanding. Yet close reading of Christensen's work reveals that the terms disruptive technology or disruptive innovation do not refer to an attribute of a technology, customer offering or a business model. Rather, they describe the effect that some technologies and/or innovations have upon markets affected by the insurgence of these new offerings, and the downturn in success of the incumbent organisations that have

failed to adopt the new approach in timely fashion (Paap and Katz, 2004; Christensen and Raynor, 2003). It is the author's observation that those who seek a rigid criteria for identifying a disruptive technology or innovation have not understood Christensen's approach to disruptive innovation theory. For example, he does not establish clear-cut criteria to determine whether or not a given technology or customer offering can be assessed as 'disruptive', as to do so would be to ignore the functions of perspective and location:

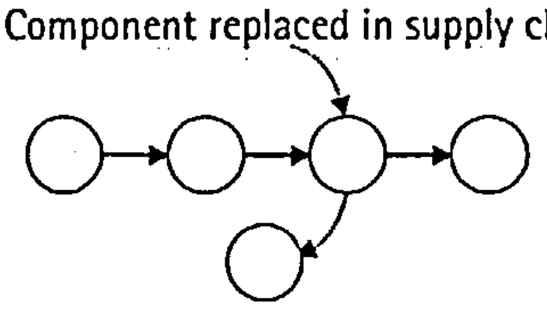
Innovation is an example of change which has a duplicitous nature (Van de Ven, 1986). What is experienced as an incremental manageable change to one organisation could reap extensive, turbulent or even devastating changes to others. Conventionally, it is conceived that disruptive innovations transform entire supply chains, value chains and entire industry systems. The original case examples used by Christensen to introduce the topic of disruptive innovation, were based upon extensive data from a range of industry transformations. It was this large scale disruption, entire market transformation and mass potential for new-wealth generation that enticed academics and business practitioners alike to the topic. However, disruptive innovations with specific impacts upon elements of supply chains have also been identified in the literature (Ulwick et al, 2003; Christensen and Raynor, 2003; Gilbert and Bower, 2002; see also Figure 2-7). Thus, disruptive innovations hold both the potential to deliver mass societal change (such as the insurgence of personal computing (Hamel, 2000) and a range of local market disruptions that can occur in different locations throughout a supply or value chain (as implied by Paap and Katz, 2004).

Consider the example of the lithium battery market. Currently, fuel cell batteries under-perform their lithium based counterparts in terms of size, weight and safety, however, their attribute set is less restricted in the performance dimension of duration of energy supply. Therefore, it is likely that incremental innovations in this low-end fuel cell technology, will soon allow fuel cell manufactures to produce rechargeable batteries with a significantly longer 'charged life' than conventional lithium batteries (BBC 2004). This incremental innovation could transform the use of, for example, laptop personal computers (PC's). To be freed from the need to recharge every few hours would be a radical improvement in performance in a direction that the majority of laptop PC users desire. A simplistic view would dictate that to deliver this radical innovation for consumers, laptop manufacturers could make an incremental change in their supply chain. They would replace the current lithium battery manufacturer with a new fuel cell producer. However, such an incremental move for laptop producers could generate a destructive market shift for lithium battery manufactures that have not invested in fuel cell technologies. Thus, the incremental innovation that supplies laptop PC consumers with a radical innovation, and perhaps even a discontinuous

change in behaviour, could be experienced by the current lithium battery industry, and its distribution channels, as a disruptive innovation.

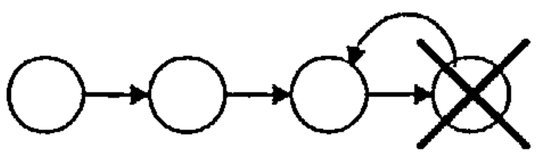
This example illustrates how the impact of a disruptive innovation is experienced differently as a matter of perspective in different locations of a supply or value chain. This could also explain why Chesbrough (2001) found that studies of the impact of technological shifts on incumbent firms lacked a common criteria by which to classify different types of technologies - different perspectives would generate different interpretations.

1. Component replaced in supply chain:



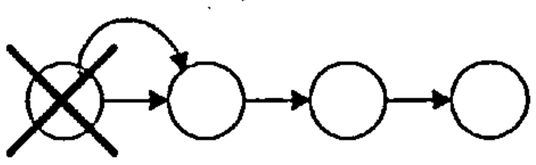
e.g. fuel cells Vs lithium batteries in laptop PCs.
- Disruptive innovation for value network of obsolete component.
- Incremental/radical innovation for system and product.

2. Innovator makes distributor redundant in supply chain:



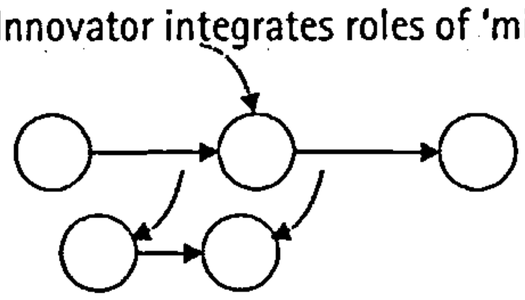
e.g. Ryanair/easyJet direct to customer Vs Traditional travel agents.
- Disruptive innovation impacting value network of "value adding" distributors.
- Radical innovation for product.
- Discontinuous innovation for low-end new-market consumers

3. Raw material provider makes move up supply chain:



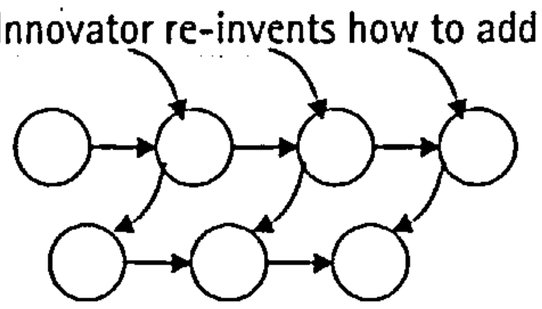
e.g. British farmers forced to add value to their produce or close down.
- Disruptive innovation impacting value network of "value adding" middlemen.
- Incremental innovation for product.
- Incremental to radical innovation for system.

4. Innovator integrates roles of 'middlemen' and adds more value to supply chain:



e.g. Google.com or Skandia (national to trans-national investment financial services).
- Disruptive innovation impacting major middleman of system's value network.
- Radical for product.
- Discontinuous innovation for system.

5. Innovator re-invents how to add value to raw resources and transforms supply chain:



e.g. Dell Vs Compaq or Ryanair and easyJet Vs Traditional Air Carriers.
- Disruptive innovation impacting system's entire value network.
- Radical Innovation for new-market and low-end consumers.

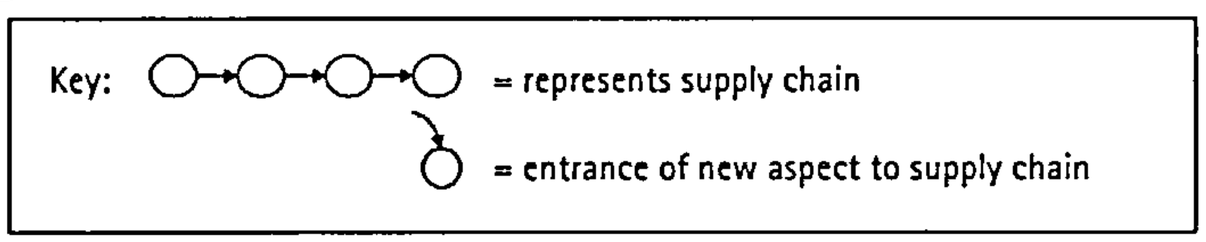


Figure 2-9: Examples of differing locations of disruption from a supply chain perspective

Author analysis of cases described by Christensen and Raynor, 2003; Gilbert and Bower, 2002 etc.

In sum, disruptiveness is a product of perspective (Kaplan, 1999), location (Paap and Katz, 2004) and the 'right' marketing skill (Christensen and Raynor, 2003). Where Christensen's work is detailed in marketing principles, his theory simply avoids the functions of varying perspectives and locations. Instead, each of his case studies is grounded in the immediate location using the immediate perspective. This negates the need to consider a more global, industry-wide perspective when focusing upon the functions of a discrete component disruption. Alternatively, it negates the requirement for him to consider the perspectives and functions of the varying elements of an existing value network, when the aim is to disrupt the traditional industrial paradigm. These issues confuse the boundaries of the theory and hinder definitions of the term disruptive innovation, and once again, this makes it difficult to identify what makes an innovation disruptive at the onset.

2.5.6 The function of competences and time within the market

A focus upon the function of an innovation's time within the market reveals a weakness in the term disruptive innovation, making it difficult to define and understand. An assessment of the model reveals it is not clear at which point in the life cycle of an innovation can it be given the label disruptive. Optimistically, the term could be used when data is available to show that the innovation has invaded the market and has transformed elements of a supply chain. A more stringent approach might dictate that the incumbents within the core market have to fall prey to the innovation before it can be labelled disruptive, where data is available to show that the innovation is now the dominant force. Once a decision is made about when it is appropriate to state that an innovation has been disruptive, the nature of Christensen's model also dictates that the term cannot then be used prior to that event. As such, innovations earmarked for low-end or new-market disruption can be referred to, at best, as 'potentially disruptive innovations'. Such difficulties of distinction cause confusion when decisions need to be made about resource allocation and business priorities (Cooper et al., 2000)

Compounding these issues further is the notion that disruptiveness could be considered as relative to the competences of incumbent organisations. Tushman and Anderson's (1986) findings could be used to support this notion; only when competencies of incumbents have been rendered obsolete could an innovation be labelled disruptive. This is consistent with elements of Charitou and Markides (2003) findings, however, not reflective of other authors. Kaplan (1999) shows that firms can follow four strategies to deliver discontinuous innovations (radical cannibalism, competitive displacement, market invention, and industry genesis), each could be used to deliver a disruptive innovation but only one directly attempts to destroy competencies. Moreover, as noted earlier, the

status quo of dominant market players can remain through a period of competence destroying activities, if such a change is desired by core lead-customers (Christensen and Bower, 1996). Therefore, it remains unclear as to the best way to conceive of an innovation as disruptive via the function of competencies.

2.5.7 Trajectory mapping and understanding product performance dimensions

Christensen's trajectory mapping approach, as previously described (Figure 2-2), provides a powerful analytical tool by which to consider disruptive innovations (Phaal, et al., 2004). When using this tool, Christensen assumes that customers' purchasing choices are dominated by the one or two performance dimensions on which he focuses. This is a weakness that has not been addressed. Evans et al. (2002) demonstrate that the number of performance dimensions which influence a customer's choice can almost be counted *ad infinitum*. They propose support for Kano's (1993) model of product quality, a more sophisticated tool that can model different types of performance dimensions ('delighters', 'linear qualities' and 'basic qualities') and the dynamic nature of their interplay (Figure 2-8)

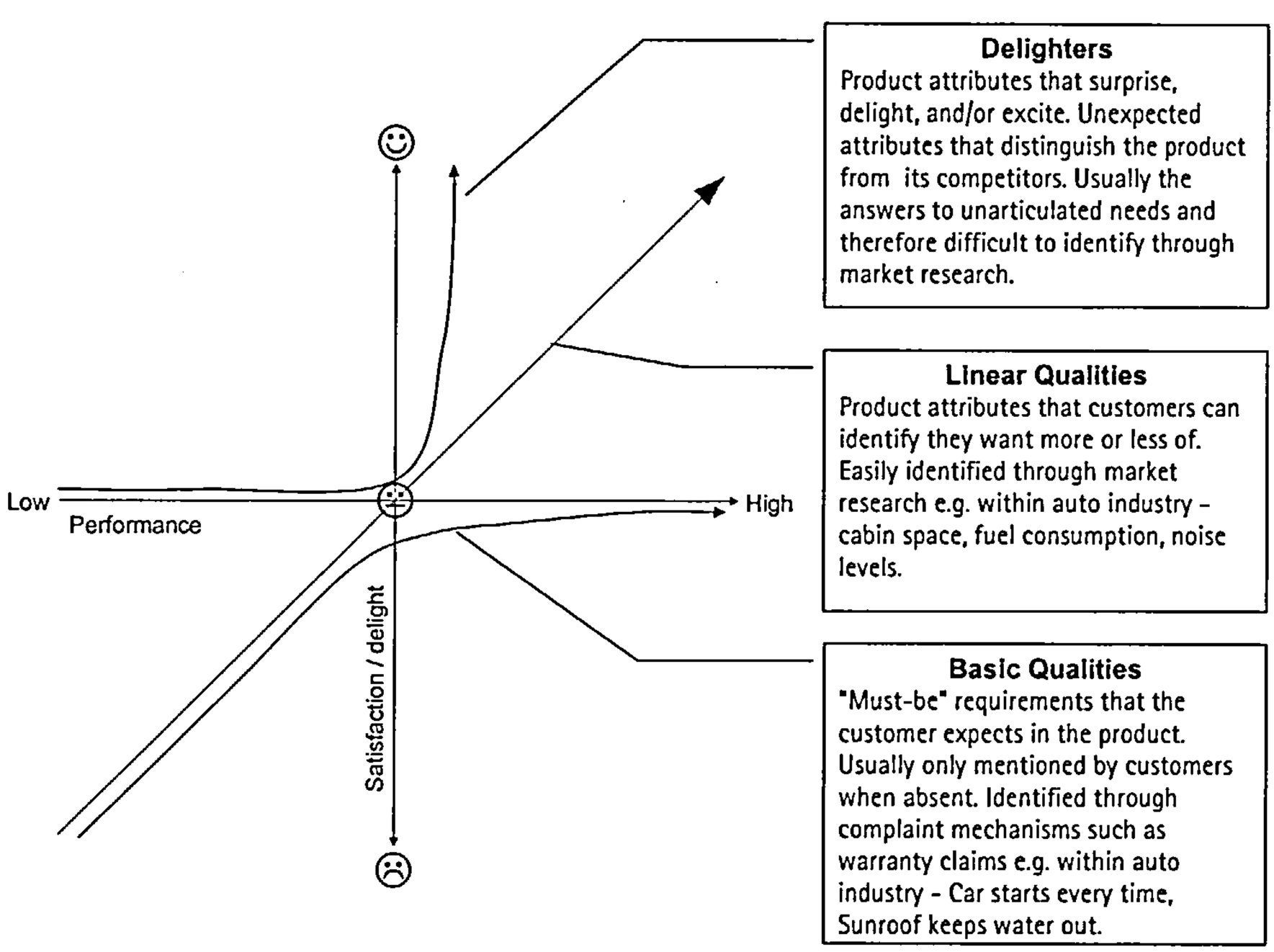


Figure 2-10: Modelling perspectives of performance quality Kano's (1993)

Kano's model illustrates that the attribute sets of a customer offering can be considered as contributing to one of three types of quality – basic, linear and delighter. This perspective can improve investment decisions regarding which attribute sets to improve, in order to increase customer satisfaction. Evans et al. (2002) note that over time, attributes rated as delighters (those that increase customer satisfaction by an order of magnitude beyond all others) become accepted as 'the norm' and transform into liner qualities; likewise linear qualities eventually become expected basic features of the product or service offering.

The use of this tool could allow organisations to more effectively map their current levels of performance and to assess the introduction of new customer offerings with differing attributes. For example, the likes of British Airways and AirFrance missed the disruptive lead of easyJet (Lettice and Smart, 2004). Using Kano's model it could be proposed that the traditional European airline carriers were continually improving a multitude of the linear and basic qualities of their customer offerings. However, they were unable to understand the significance of the growing customer base of the low-cost-no-frills point-to-point air travel operators, as they had no means by which they could understand how this overlooked niche of customers, and the low-cost delighter, could be mapped to the mainstream. Christensen's trajectory maps are limited by the prerequisite of tracking specific key performance measures over time, thus making the onset of a potentially disruptive innovation difficult to gauge. However, a model offering a more comprehensive assessment of performance dimensions, such as that offered by Kano (1983), could allow a more accurate appraisal of the motivation surrounding purchasing choices, whilst improving the ability of management practitioners to assess the impact of changing attribute sets of customer offerings.

2.5.8 The relationship between disruptive innovation and absorptive capacity

Cohen & Levinthal (1990) are pioneers of the term 'Absorptive Capacity'; they state that it refers to organisational learning, explicitly the commercial application of external information. They argue that absorptive capacity is critical to a firm's innovation process – the higher the capacity the more effective the process.

Stock et al. (2001) highlight that the construct has been "studied across a wide spectrum of research, including investment in research and development, research productivity in pharmaceutical firms, innovation in banking services, information technology use, inward technology licensing, strategic alliances, knowledge transfer, and organizational learning" (p78). Moreover, they explored whether greater levels of absorptive capacity are related to the development of more technologically advanced products and found that the relationship between

absorptive capacity and new product development performance is nonlinear. In fact, they state that the relationship could be mapped by an 'inverted-U' shape, and conclude an organisation's levels of absorptive capacity can reach a point of diminishing returns, where the adoption of too much knowledge confuses the priorities of the innovation effort

The theory of disruptive innovation, as presented above, indicates that the pursuit of potentially disruptive innovations (that is the increasing of an organisations capacity and capability to foster and deliver disruptive innovation[5]) is an important, knowledge-intensive, commercial activity. Therefore, it could be stated that organisations may require high levels of absorptive capacity to positively and effectively pursue these new product and service developments. However, not only is there an absence of consideration for this critical construct in the extant literature pertaining to disruptive innovation, but Atuahene-Gima (1992) claims there to be an inadequate quantity of research that relates absorptive capacity to innovation management. This is an issue that leaves gaps in the theory of disruptive innovation and perhaps the base of knowledge upon which it rests.

2.5.9 Barriers to disruptive innovation

Some of the most significant gaps in knowledge regarding disruptive innovation revolve around barriers to the phenomenon. Paap and Katz (2004) emphasise the difficulty faced by organisations when trying to internalise both sustaining and disruptive innovations. They refer to the problems faced by the executive board of the world's leading fast moving consumer goods organisation, Proctor and Gamble: the stock market made a request that they introduce new wealth creating products, only to rescind this request when it was clear that despite the successful launch of new products, they had lost focus in core product categories and had suffered losses as a result of new market entrants in the form of low-end disruptors. This is just one of many barriers identified in the literature that organisations face in the pursuit of potentially disruptive innovations (see Table 2-1).

[5] This is the definition that is referred to when the author states the 'pursuit of potentially disruptive innovations' throughout the remainder of this thesis.

Examples of Barriers to Disruptive Innovation Described in the Literature	Examples of Authors
A failure to understand the different marketing principles needed for disruptive innovation.	Trott, 2001; Christensen, 1997; Udall, 2001; Hamel, 2000; Moore, 1995; Gilbert & Bower, 2002; Christensen & Overdorf, 2000
Inability to think out of the box in order to create, generate or recognise disruptive opportunities.	Ahuja & Lampert, 2001; Amabile, 1997, 1998; Andriopoulos, 2001; Gilbert and Bower, 2002; McFadzean 1998, 2000; Rice et al, 2001; Unsworth, 2001.
Organisational ecologies (culture + environment + infrastructure) that restrict ideas and are focused on incrementalism.	Ahuja & Lampert, 2001; Rice, et al., 2001; Christensen, and Raynor 2003; Amabile, 1998; Allen, et al., 1999; Dvir et al., 2002.
Inappropriate management of potentially disruptive ideas.	Allen, et al., 1999, Ahuja & Lampert, 2001; Rice et al., 2001; Amabile, 1998; Hamel, 2000; Veryzer, 1998.
An inability to challenge organisational assumptions leads to a failure to appropriately scan or 'futurise' for disruption.	Rice, et al, 2001; Hamel, 2000; McFadzean, 1998; McFadzean 2000; Stevens, et al., 1999; Leifer et al, 2000.
Inappropriate project funding with narrow, focused project selection.	Christensen, 1997; Christensen and Raynor, 2003; Cooper et al, 1999 & 2001; Gilbert and Bower, 2002; Hamel, 2000; Ahuja & Lampert, 2001; Rice et al., 2001.

Table 2-1: Barriers to disruptive innovation as identified in the first round literature review

Kuhn (1970) illustrated that prevailing theories often determine what is seen, therefore, explaining why many eminent scientists have failed to see the scientific breakthroughs that lay before their eyes. This notion introduces psychological issues, as an additional inhibiting factor in relation to those highlighted in table 2-1. Senge (1990) summarises this as the impact of mental models – the cognitive representations that people hold of the realities in which they partake; he illustrates how they impact what we do, in part because they effect what we see: "... two people can observe the same event and describe it differently... because their mental models focus their attention upon different details" (Senge, 1990:175). For example, Mitroff (1988) demonstrated that the root of General Motor's downfall was linked to its top management team's willingness to hold onto its beliefs (i.e. the deep routed mental model that success was linked to cars as status symbols and traditional styling). In this case, the mental model was tacit and not explicit, therefore, the management team was blind to it and its impact. Similarly, Tripsas and Gavetti (2000) found that

it was the rigid behaviours of the executive management team of Polaroid - which was based upon narrow beliefs - that resulted in the organisation's demise. They call for more research into the effects of management cognitions. Three approaches from psychology and psychology based research may provide insights:

- Oliver et al. (1997) demonstrate that the stimulus provided by an idea or product evokes cognitions, which are either congruent with expectations or disconfirmatory. Such cognitions are said to evoke both emotions (also known as 'affects'), such as surprise, arousal, pleasure and joy, and behaviours, such as actions to pursue, to purchase or to invest.

- DeBono (1968, 1988) stated that a fixation upon routines or mental models occur as the result of psychological inertia – where people become trapped into patterns of thinking and behaving.

- An area are of cognitive psychology that perhaps contributes the most understanding to this issue (White and Bessant, 2004) is theory cognitive dissonance (Festinger, 1957; Harmon-Jones and Mills, 1999). Two cognitions are said to be dissonant if one does not follow from the other; for example, an idea that is incongruent with a prevailing mental model. The existence of cognitive dissonance is psychologically uncomfortable, and as such, those that experience dissonance are motivated to make efforts to reduce it. Moreover, the greater the magnitude of the dissonance, the greater the pressure to employ dissonance reducing strategies (Harmon-Jones and Mills, 1999) such as ignoring the dissonant information and looking for facts that support the prevailing mental models (Senge, 1990).

2.5.10 Methodological gaps in Christensen's approach

- **Data sets: a failure to consider average performing organisations**

Analysis reveals that the literature in the field of disruptive innovation that is not based upon conjecture is primarily focused upon leading edge organisations or those that have been disrupted from their industries. This has discounted the experience of average performers, demonstrating a

gap in academic knowledge and an even wider gulf in practitioner-understanding regarding the application of the theory. For the completeness of the theory, organisations from all relevant populations should be considered (Eisenhardt, 1989; Yin, 1993). Thus average and non-best in class organisations should be considered as a viable population from which data can be drawn.

- **Generalisability: making generalisations from case data**

Christensen has built much of his theory from extensive quantitative analysis of several case study markets. Positivistic approaches usually allow the researcher to adopt statistical measures to assess margins of error and to use quantitative methods to search for generalisations to broader populations (Silverman, 2000). However, Christensen's case based approach means that he has collected and analysed historical data that is empirically grounded in the specific industries or technologies under focus. Thus, he has generated new insights regarding the process of disruptive change in numerous industries but has failed to note, to some extent, that it is not statistically correct to generalise case based findings to a global theory (Eisenhardt, 1989).

For example, much emphasis has been placed upon Christensen's (1997) analysis of the hard-disk-drive industry in the United States. This work provided the corner stone of evidence regarding the process of disruptive innovation: where start-up entrants displace industry incumbents. However, Christensen failed to address the national context from within which the process of disruption occurred. Alternatively, Chesbrough (1999; 2003) found that the incumbents of Japan's hard-disk-drive industry undertook organisational-level change and transferred to the new technologies, thus remaining in place. He concludes that industry wide disruption is contingent upon national contexts and that no amount of smart product positioning and marketing will facilitate disruption if the national context does not support such fluid change.

In sum, it is dangerous to make generalisations, which cannot be otherwise supported, from case study data. Christensen could, however, build his argument by augmenting it to other patterns of technological and industrial change, for example the previously discussed population dynamics and resource partitioning perspectives. In doing so, it could be possible to identify markets, industries and nation states where the process of disruption is more likely to occur and the theory of disruptive innovation is more likely to stand as true.

- A lack of longitudinal research: avoiding sampling on the dependent variable

Truly customer-orientated firms do attempt to understand their customers' needs, even their dormant and unexpressed desires (Allen et al. 1999). Yet the businesses portrayed by Christensen (1997) and Christensen and Raynor (2003) display an almost superficial understanding of customer needs or product selection criteria. It could be argued that Christensen has been 'sampling on the dependent variable' (Robson, 1993), falling prey to the temptation of selecting cases to support a predetermined thesis. To quash such accusations, theory of disruptive innovation could be assessed by conducting longitudinal research. Such research would monitor and analyse, in real time over a number of decades, several emergent technologies in several areas of the world, perhaps in industries in which technological history is already well documented. By creating transparency in data collection and analysis, conclusions drawn from such research would be less open to criticism.

- A lack of qualitative research: delivering a probing of management action and cognition

Analysis reveals that the literature in the field of disruptive innovation is primarily positivistic in nature. There is a lack of qualitative management research that aims to better understand the managerial behaviours and beliefs that support or inhibit the organisational pursuit of disruptive innovation. Danneels (2004) observes that "... individual managerial competence does play a significant role and should be an explicit focus of research into the determinants of incumbent success. Some managers do seem able to lead their firms across technological transitions..." (p254). Much of the literature has focused upon better understanding the process of disruptive innovation and the global conditions in which it seems to thrive in each case. Research is now needed to investigate the qualitative micro factors of the phenomenon, it is proposed that such consideration of management issues enhances both academic understanding and industrial thirst for practical guidance (Johnson et al., 2003).

2.6 A definition of the term disruptive innovation

Despite the issues that frustrate a clear definition and understanding of the terms 'disruptive innovation' and 'potentially disruptive innovation', it is believed that the above assessment of Christensen's work can be summarised to provide definitions of these terms. Therefore, the following were used throughout this research:

A disruptive innovation is:

a customer offering based upon one or more new technologies and/or processes that have enabled the introduction of new attribute sets, which in turn have changed the basis of competition by changing the performance dimensions along which organisations compete.

A potentially disruptive innovation is:

a customer offering based upon one or more new technologies and/or processes that enable the introduction of new attribute sets which, if marketed appropriately, are likely to change the basis of competition, by changing the performance dimensions along which organisations compete.

The five most frequently cited attributes of disruptive innovation appear to be[6]:

- The new attribute sets of potentially disruptive innovations are initially neither expected nor desired by lead/high-end customers; customers and suppliers within the mainstream initially perceive an unwanted reduction in functionality.
- The disruption takes a foothold in an underserved or overlooked customer segment (or with those who currently choose non-purchase as an alternative); potentially disruptive innovations should never be lunched directly into the mainstream market.
- Relationships between customers and suppliers are transformed as customers are enabled to do things in a more convenient setting that could have only been achieved with specialists in the past.
- Incumbent organisations' focus on mainstream customers and historical trajectories of performance, result in their lack of ability and desire to identify or recognise potentially disruptive opportunities or threats.
- The process of disruption is enabled through niche marketing using either a 'low-end' or a 'new-market' strategy; 'being patient for growth but impatient for profitability' forces management teams to stay focused on customer niches with a compelling reason to buy.

[6] This list was generated following a critical appraisal of the literature on the topic disruptive innovation and the broader fields of discontinuous and radical innovation. It generated 18 themes or key features of the term disruptive innovation as defined above (see Appendix 1b Table B-1).

The definition and the features of potentially disruptive innovations, as outlined above, introduce the notion "if marketed appropriately"; an essential element of the definition. Christensen's theory highlights that the first customers for disruptive offerings will be found in remote or emerging market niches, and that it is from these customers that a path to disruption can be carved (Rafii and Kampas, 2002) via niche marketing approaches. Similarly, Carroll (1985), Hannen and Freeman (1984) and Wade (1996) show that it is through the process of niche market satisfaction that resource-partitioning and industry population dynamics can be explained. Furthermore, there exists extensive literature on the importance of marketing approaches for emergent technologies and customer offerings. For example, proponents and supporters of technology adoption lifecycle theory, such as Moore (1995, 1998, 2000, 2002), state that the single most important failure of potentially revolutionary concepts is management teams who ignore those small groups with a compelling reason to buy, preferring to take their new offerings directly to large mainstream markets:

> *"...this tendency always to take new technologies to mainstream customers reflects a rather narrow marketing competence - that although many scholars tend to frame the issue as one of technological competence, such inability to find new markets for new technologies may be a firm's most serious handicap in innovation" (Christensen, 2000:58).*

In almost all of Christensen's self authored and co-authored publications there is reference to the importance of marketing approaches and he draws from a wealth of literature to describe techniques that can help with this process. This thesis aims to address gaps in the theory of disruptive innovation, thus this issue will not be critically appraised. Instead it is believed that this chapter summarises a deeper understanding of the term disruptive innovation and the prevailing problems with the theory. This provides a grounding from which a novel piece of research can be conducted, which, as will be explained in the following chapters, will offer a relevant and meaningful starting point for the continuation of qualitative investigations in the future.

2.7 Summary and focus of the thesis

2.7.1 The notion of disruptive innovation

Organisational innovation effort is traditionally focused upon performance improvement in attributes most valued by the most demanding customers - those willing to pay higher prices. Thus, both incremental and radical innovations offer performance improvements within the dimensions and directions that lead-customers (McDonald et al, 2001) desire and expect (O'Connor and Rice, 2001; Rothwell, 1995; Christensen, 1997). However, occasionally breakthroughs occur with a discontinuous impact upon this steady state (Christensen, 1997, Dosi, 1982; Schumpeter, 1975).

Conventionally, discontinuous innovations offer revolutionary leaps forward in performance improvement, in directions that lead-customers desire, yet break the steady-state as they are not yet expected to be possible (Christensen, 1997; DeTienne and Koberg, 2002). However, there is a type of lesser understood discontinuity, known as 'disruptive innovation'. A disruptive innovation is a customer offering based upon one or more new technologies and/or processes that have enabled the introduction of new attribute sets, which in turn have changed the basis of competition by changing the performance dimensions along which organisations compete. Thus, disruptive innovations can be considered as potential threats or as 'wellsprings of future sustaining innovation' (Kassiecieh et al 2002).

2.7.2 A critique of disruptive innovation

The literature on innovation and new product development has evolved to capture a number of important understandings and ideas on innovation of a disruptive nature. The rise of Clayton Christensen's theory of disruptive innovation has both contributed to and facilitated the growing base of research into the topic, yet problems remain regarding definition and clarity. Therefore, this chapter has delivered a critical review of the theory of disruptive innovation (summarised by Table 2-2). It demonstrates that the phenomenon, with examples, has been described by a number of authors, from a number of different perspectives and it offers descriptions of factors that cause academics and management practitioners to struggle to understand and capitalise upon these important innovations.

Issue	Author	Implications for disruptive innovation theory.
A typology of discontinuous innovation.	Veryzer (1998)	- Less categorised appraisal of the origins and management implications of disruptive innovations.
'Dynamic drifting' & extensive prototyping	Veryzer (1998)	- Unclear guidelines with specific reference to the traditional NPD process.
Business concept innovation	Hamel (2000)	- Too technology focused not enough attention to wider system changes.
Population dynamics & resource partitioning	Hannan and Freeman (1984); Wade (1996)	- Could be used to provide a quantitative evidence base of industry change. - Casts doubt over the claims of generalisability made by Christensen.
An holistic conception of disruptive innovation	Deszca et al. (1999); Cooper et al. (2001)	- It is difficult to conceive or communicate an holistic understanding. - There is a failure to consider qualitative issues.
The function of perspective and location	Ulwick et al, (2003); Paap and Katz (2004).	- Confuses the boundaries of the theory, hindering definitions, making it difficult to identify what makes an innovation disruptive at the onset.
The function of competences and time within the market	Cooper et al. (2000); Kaplan (1999)	- Confuses decision making for resource allocation and business priorities - Should not conceive disruptiveness as an impact on organisational competence.
Trajectory mapping and understanding product performance dimensions	Evans et al. (2002); Kano (1993)	- Could be improved by using more sophisticated mapping of performance dimensions.
The relationship between disruptive innovation and absorptive capacity	Cohen & Levinthal (1990);	- There exists a lack of understanding regarding the role of acquiring and commercially applying external information.
Barriers to disruptive innovation	Ahuja & Lampert (2001); Amabile Rice et al. (2001)	- Industrial and academic gaps regarding disruptive innovation and: marketing, recognising opportunities, organisational ecologies, ideas management, scanning and 'futurising' and project funding.
Methodological gaps in Christensen's approach	Silverman (2000); Yin (1994); Strauss and Corbin (1990).	- A failure to consider average performing organisations. - Making unjustifiable generalisations from case data. - A lack of qualitative data regarding managerial behaviours and beliefs - A lack of objectively verified longitudinal research.

Table 2-2: Gaps in knowledge in the theory of disruptive innovation:

a table to summarise factors that remain unresolved.

2.7.3 Addressing gaps in knowledge

At the outset of the research there were, among others, three important gaps in knowledge to which it was decided that this thesis would be dedicated:

(1) a clear definition of the term disruptive innovation was unavailable,

(2) a coherent unified framework of enablers and inhibitors with direct relevance to the ability to foster disruptive innovation was not present, and

(3) much of the research in the field was positivistic and involved leading edge organisations; loosing the benefits of qualitative understanding and discounting the experience of average performers. This demonstrates a gap in academic knowledge and an even wider gulf in practitioner-understanding regarding the application of the theory.

This chapter culminated in a working definition of the term disruptive innovation (Section 2.6), it was decide to use it throughout the remainder of an investigation focused upon points 2 and 3 above.

2.7.4 Research objectives and next steps

The following Chapter, the research methodology, will demonstrate that systematic consideration has been given to the *main* issues of research design in order to address the research objectives presented in Table 2-3 below. Three waves of research were designed and implemented to tackle the three sub-objectives.

Research Objective 1:	To explore the nature and experience of management practitioners' pursuit of potentially disruptive innovations in average performing (or non-best-practice) businesses.	
	Sub-Objective 1:	To deliver an holistic understanding of the key facilitators and inhibitors faced by management practitioners wanting to enable the capacity and capability to pursue potentially disruptive innovations within their non-best-in-class organisations. And to convert this knowledge into an holistic processual and systemic conceptual framework, grounded in both data and theory.
	Sub-Objective 2:	To explore the emergent conceptual framework in order to identify focus areas of management action and management cognition to which the delivery of potentially disruptive innovations are highly dependent.
	Sub-Objective 3:	To specify, design and implement a management intervention to probe a priority focus area of management action and cognition. The intervention should be able to build new academic knowledge, whilst simultaneously improving the ability of the participating organisations to pursue potentially disruptive innovations.
Research Objective 2:	To use this investigation as a tool to extend knowledge and practice of collaborative academic-practitioner methodological approaches in the field of innovation research.	

Table 2-3: Research Objectives

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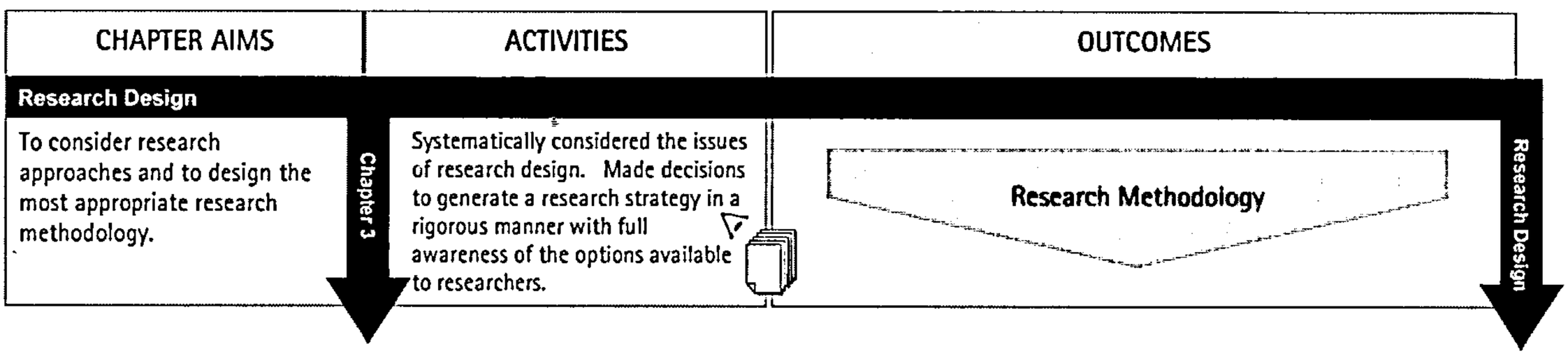
3. Research Methodology

This chapter presents the research methodology that was designed in order to satisfy the research objectives presented in Chapters 1 and 2. A phenomenological perspective was adopted with a focus on qualitative research. A collaborative academic-industrial research design was developed, adopting what has come to be known as the Mode 2 approach (Tranfield and Starky, 1998), with primary use of a multiple case study strategy. Data were collected using multiple methods, including workshops, interviews and industrial visits; they have been analysed using both individual examination and collaborative practitioner inspection. The purpose of the research was to explore and describe the phenomenon of fostering disruptive innovation.



The function of research is not
necessarily to map and conquer the world
but to sophisticate the beholding of it.

(Stake, 1995)

3.1 The purpose of the current inquiry and the affect of research perspectives

The objective of this chapter is to demonstrate that systematic consideration has been given to the main issues of research design - that the decisions which led to the research strategy used in this study were conducted in a rigorous manner, in full awareness of the options available to researchers.

The preceding chapter illustrated that despite a recent increase in publications upon the topic of disruptive innovation, an holistic understanding of these factors is still missing. Furthermore, at the outset of this investigation, little was published about the factors of management cognition and management action that practitioners, within average performing organisations, should address 'today' if they want to initiate their pursuit of disruptive innovation. Therefore, disruptive innovation, as a subset of the whole innovation agenda, is a relatively new field, as compared to

disciplines such as Corporate Strategy or Marketing. Robson (1993) argues that in addition to the objective of contributing to knowledge, there are three purposes to undertaking research; these are to explore, describe or explain events and/or situations (Table 3-1). Given the novelty and immaturity of the topic area, the primary purpose of this study is exploratory; however, the current research not only aims to *explore* the interrelated features of the pursuit of disruptive innovation, it also aims to *describe* how it can be enabled within average performing organisations, focusing in particular upon management cognition and management action.

Purpose	Key Characteristics
Exploratory	• To find out what is happening • To seek new insights • To ask questions • To assess phenomena in a new light • Usually, but not necessarily qualitative
Descriptive	• To portray an accurate profile of persons, events or situations • Requires extensive previous knowledge of the situation etc. to be researched or described, so that you know appropriate aspects on which to gather information. • May be qualitative and/ or quantitative
Explanatory	• Seeks an explanation of a situation or problem, usually in the form of causal relationships • May be qualitative and/or quantitative

Table 3-1: The purpose of research – to explore, to describe, to explain (Robson, 1993:42)

Researchers conducting investigations that aim to explore, describe, understand, explain, predict, change or evaluate topics in the management world, such as disruptive innovation, are conducting inquiries into a social phenomenon (Blaikie, 1993). Authors such as Miles and Huberman (1994), Robson (1993), Yin (1994), Gill and Johnson (1991), Easterby-Smith, Thorpe, and Lowe (1991), Silverman (1999) and Blaikie (1993) show there are numerous ways in which to approach a social inquiry and that these vary according to the perspective that the researcher adopts when looking at his or her research questions. Differences in research perspectives are typically characterised as a debate between two major and opposing world views or methodological paradigms (Patton, 1990) – "in the red-corner is phenomenology, in the blue-corner is positivism" (Zikmund, 1988), although there are perspectives that can be adopted between these extremes (Blaikie, 1993).

Thus, the choice of investigative methods employed in a social inquiry is influenced by how much either of the two schools of thought affects the researcher's perspective. Robson (1993) and Yin (1994) state that before undertaking an investigation, researchers must recognise the existence of their personal beliefs, biases and assumptions and should consider the suitability of different research perspective for the topic in hand. In doing so, researchers will better understand which research perspectives to adopt and will be more self aware during the development of an appropriately designed research strategy.

Social scientists who are advocates of the positivist paradigm believe that the social world exists externally and can be measured through scientific, objective methodologies. Positivists use careful observation and meticulous testing through experiments, quasi-experiments and rigorously defined surveys. This enables theory to be deduced to explain causal relationships between variables (Denzin and Lincoln, 1994). Thus the positivist perspective uses a deductive research approach. Robson (1993) states when beginning such a study researchers first deduce a hypothesis from extant theory. They then express the hypothesis in operational terms to propose a relationship between specific variables. An experiment or some other form of empirical inquiry will be conducted to test the operational hypothesis. An examination of the outcome of the inquiry is conducted in order to confirm the theory or reject it. A rejection indicates the need for theory modification in the light of the findings. If modification is required, repetition of the cycle is conducted in order to verify the revised theory and confirm research hypotheses (Robson, 1993).

Alternatively, advocates of the phenomenological paradigm state that reality is socially constructed rather than objectively determined. Social scientists who hold this perspective focus on understanding what is happening and why, by collecting and understanding data from social interactions in their natural settings. This necessitates the use of more naturalistic methodologies, such as case studies, ethnographic observations and interviews. These more qualitative approaches are without physical or statistical controls; this enables researchers to inductively generate context-bound understanding to underpin theory (Denzin and Lincoln, 1994; Easterby-Smith, Thorpe, and Lowe, 1991).

Patton (1990) illustrates the major difference between the two schools of thought. Whereas the experimental design underpinning the positivist-deductive approach requires the specification of main variables and the statement of specific research hypotheses *before data collection begins*. "The strategy of [phenomenological] inductive design is to allow the important analysis dimensions to emerge from patterns found in the cases under study, without presupposing in advance what the

important dimensions will be" (Patton, 1990:44). Thus inductive research is mostly linked with theory building, whereas deductive research is linked with theory testing (Eisenhardt, 1989).

It is the author's opinion that these seemingly incompatible approaches can be brought together by considering the demands that an inquiry places upon the researcher (Figure 3-1).

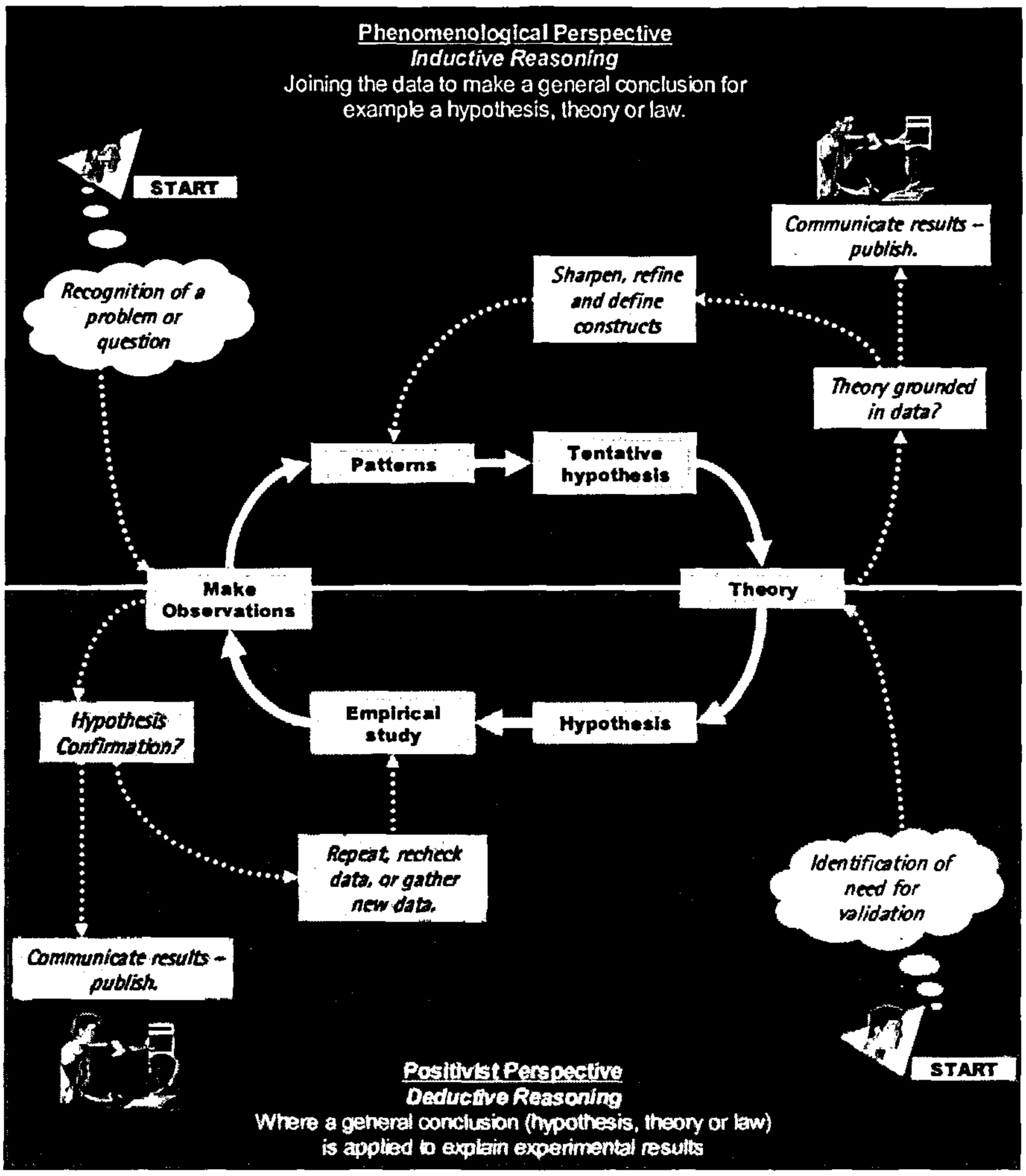


Figure 3-1: Building and testing theory with the phenomenological and positivist perspectives (an illustration derived by considering the publications of Blaikie (1993), Miles and Huberman (1994), Patton (1990), Silverman (1999) and Robson (1993)).

Researchers who want to initiate the building of missing theory, can do so using a phenomenological perspective in an exploration of the relevant aspect of the social world. Those who want to continue their pursuit of knowledge development can then test the validity of their emergent theories by adopting a positivist approach, in more experimental conditions, that may

involve manipulating the reality under consideration. As this investigation seeks to address gaps in knowledge, Figure 3-1 illustrates that a phenomenological perspective is the more appropriate perspective to adopt for this research, this is also more suited to the authors personal research approach.

3.2 Developing a research strategy that delivers both robustness and relevance

In essence, this thesis aims to provide a better understanding of how management practitioners can facilitate the pursuit of disruptive innovation when their organisations have not successfully undertaken such a task in recent memory. New and Payne (1995:75) state that "It is possible to have academic research which scores high on rigour and cleverness but low on connection to real problems...", therefore, they claim that in management, more than any other discipline, there is a fundamental need to make a "... commitment to an encounter with that which management and workers do..." (p75). However, Stewart et al. (2002) observe the complex, challenging and sometimes problematic relationship between management practice and the practice of management research. According to Tranfield (2002) and Hill et al (1999), the testing relationship primarily exists due to the perception that a push for academic rigour in management research has negative consequences for industrial relevance and vice versa. Considering the context bound nature of the subject matter, it was necessary to give this issue significant attention.

The major gaps in knowledge on the topic of enabling disruptive innovation are predominantly focused around management action and management cognition; therefore, investigations into these areas, by their very nature, must be immersed in context and both academically rigorous and industrially relevant. Coghlan and Brannick (2001) state that researchers can adopt an approach called *Action Research* when their research questions relate to describing an unfolding series of actions over time within a system and understanding how and why action can change or improve the working of some aspects of that system. Originating in the 1940's, action research is a generic term, which covers many forms of action orientated research. It differs from traditional positivist approaches as it "... is an approach that aims both at taking action and creating knowledge or theory about that action" (Coughlan and Coghlan, 2002:220), yet remains genuinely scientific in the importance it places upon careful observation and study of the effects of human behaviour on human systems (Reason and Bradbury, 2001). Coughlan and Coghlan (2002:224) and Susman and Evered (1978) have compared action research with positivist science, they conclude:

- The aim of the research is different; positivist science focuses upon universal knowledge, theory building and testing, whereas action research is concerned with theory building and testing with knowledge in action.
- The researcher's role and relationship to the setting is different; they are an observer in positivist science with a detached and neutral role, whereas they are required to be an actor or agent of change in action research, immersed in the context that is the field of study.
- The type of knowledge acquired is therefore different; positivist science focuses upon universal knowledge and covering laws, whereas action research is concerned with the particular, context specific knowledge.
- The nature of data validation is also different; positivist science aims to be context free, focusing on measurement, building logic and creating consistency of prediction and control, whereas action research is experimental, with contextually embedded validation.

It can be noted that the features of action research are more suited to the objectives of this investigation that those of traditional positivistic science. However, Coughlan and Coghlan (2002) note that there are certain circumstances that are needed before entering into action research: "... what is needed is a real issue of both research an managerial significance upon which a group or organisation is embarking, which has an uncertain outcome and which the group or organisation is willing to subject to rigorous enquiry, particularly the analysis and implementation of action." Thus, an action research approach in the context of this study would need a willing group or organisation(s) to take part in the investigation, not only to explore the pursuit of disruptive innovation but also to implement action in order to actually initiate the pursuit. In sum, "The grounded, iterative, interventionist nature of action research ensures closeness to the full range of variables in settings where those variables may not emerge all at once" (Westbrook, 1995:18), it is, therefore, a suitable and justifiable epistemological and research approach for this investigation.

Hill et al. (1999) and Huff (2000), along with others from the British Academy of Management (e.g. Tranfield and Starkey, 1998) have extended the action research perspective and elevated the concept of *collaborative 'Mode 2' methodological approaches* to the fore of management inquiry. The Mode 2 approach offers researchers the opportunity to simultaneously seek industrial relevance without sacrificing academic rigour. Similarly to action research, this is based on the premise that working closely with practitioners and *co-creating knowledge and understanding* in the context of

application will satisfy the aims of both the academic and industrial audiences. There are four features that typify the Mode 2 approach to research (Figure 3-2).

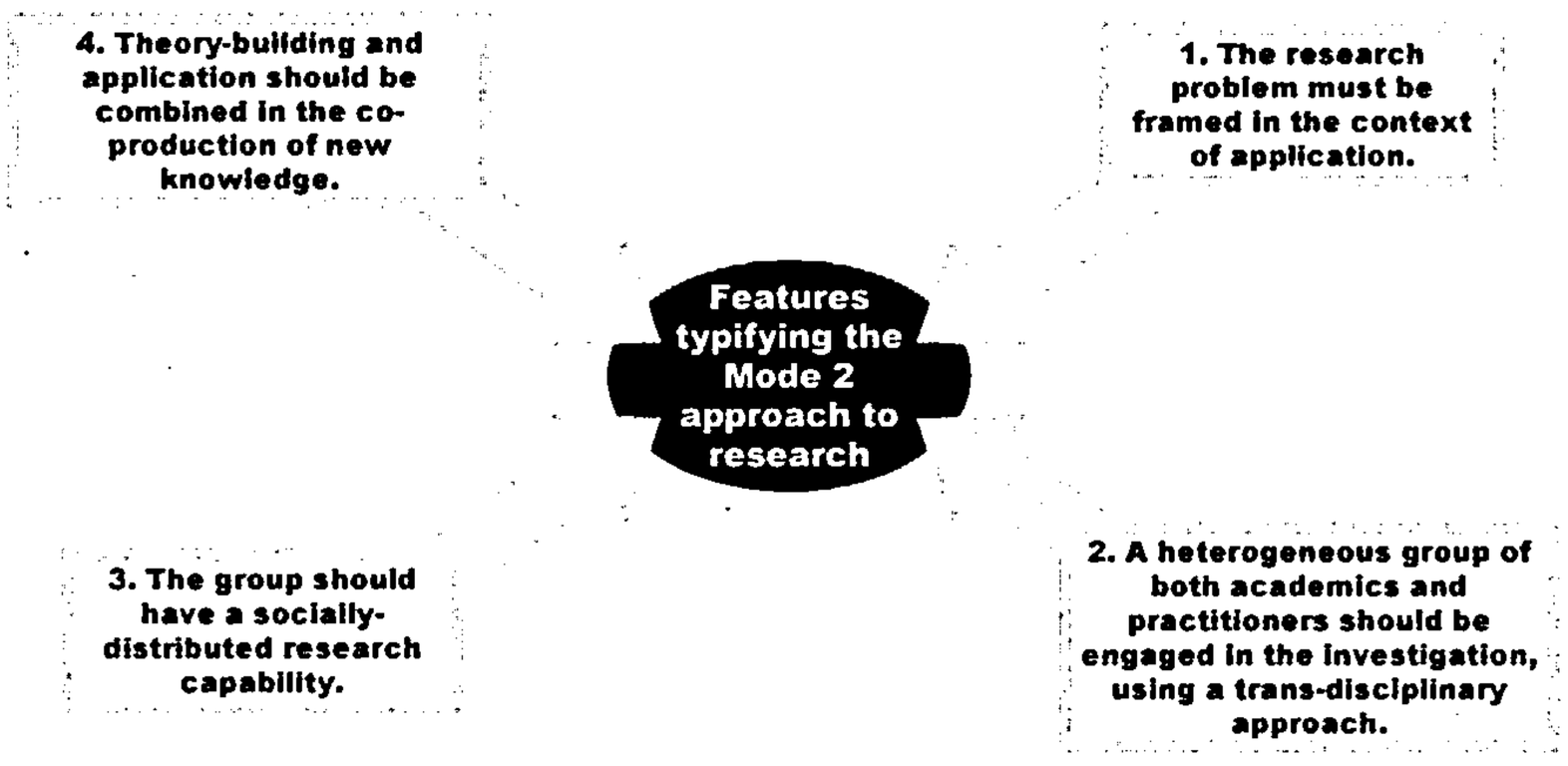


Figure 3-2: The four features that typify the Mode 2 approach to research (adapted from Stewart et al., 2000)

The Mode 2 action research approach resonates with the author's need to conduct an academically robust and industrially relevant investigation, and can fit to the phenomenological perspective. Thus it has significantly influenced the research approach developed for this investigation, which can be described as a 'researcher driven, collaborative, action research, knowledge-building style' (Figure 3-3).

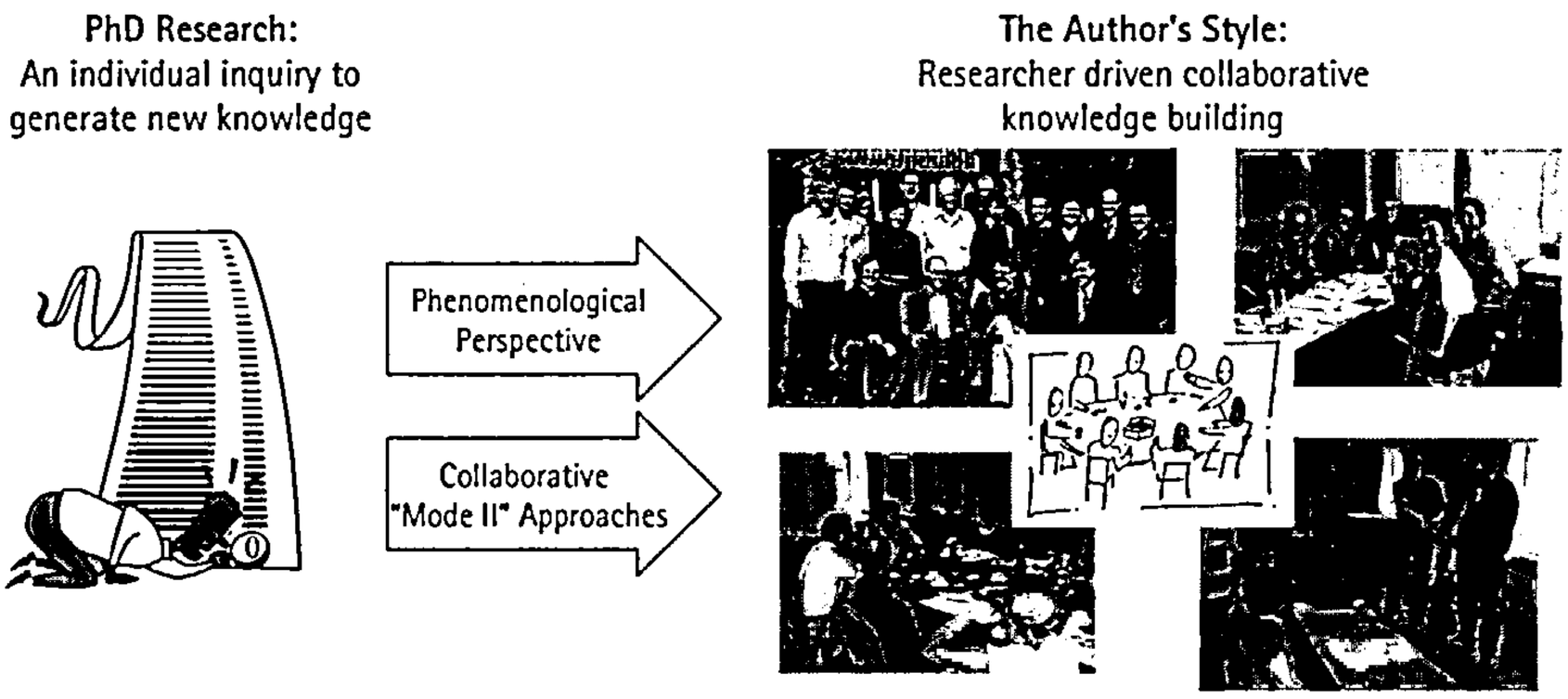


Figure 3-3: The author's style of inquiry

Reason and Bradbury (2001) and Coughlan and Coghlan (2002) are among a growing number or authors to propose step by step processes for conducting action research. These can be summarised

into six key stages (data gathering, data feedback, data analysis, action planning, intervention, evaluation) and one meta-stage (monitoring and feedback throughout the entire process), they also propose a host of qualitative and qualitative data collection and analysis techniques. However, despite convincing and growing arguments stating the need for more industrial-academic, Mode 2 investigations, researchers have few specific guidelines on which research strategies to select or why it is important to do so. Furthermore, whilst several authors elude the problems with conducting collaborative inquiries, not one proponent of Mode 2 appears to have offered researchers an holistic list of issues to consider or how to mitigate for such complications. Thus, guidelines on what constitutes delivering Mode 2 research are available (such as the generic processes proposed by advocates of action research); however, there is an absence of literature from which researchers can draw standard methodologies. Also missing is advice on good practice routines to help researchers with cultivating the necessary joint ownership of an academic-industrial collaborative inquiry.

Thus, the proceeding sections of this chapter present the strategic decisions that have been made to design the robust research methodology that was implemented for the investigation in hand. Furthermore, to aid future researchers wishing to benefit from the Mode 2 approach, this chapter offers a detailed overview of the delivery of the collaborative research methodology that was employed for the current inquiry into disruptive innovation.

3.3 A research strategy to satisfy the objectives of the current investigation

Full consideration of the available methodological approaches has been made and will be presented in the remainder of this chapter (see also Appendix 2). The research strategy benefits from both the advantages afforded by collaborative action research, as advocated by Tranfield (2002), and the benefits of tried and tested methods underpinning research of a phenomenological nature.

The researcher driven, collaborative, knowledge-building style has influenced the design of the current investigation. It was anticipated at the outset that this investigation would provide the academic audience with improved theory or new knowledge and the industrial audience with practical insights to improve their organisation's attempts at fostering disruptive innovation. Yet before selecting and designing a detailed research strategy, it is important to consider the type of research questions that have been posed, the focus on contemporary events and the control required over proceedings (Yin 1994). Thus, the collaborative nature of the research, with the

phenomenological perspective – void of traditional experimentation – lends itself to the development of a combined, multiple case study and survey methodology, underpinned by the action research, Mode 2 approach. This deliverers a primarily inductive approach for building new knowledge on disruptive innovation from the outset, concluding in a deductive and inductive approach to deliver management implications.

Silverman (1999) suggests that researchers should consider the characteristics that are consistent with the requirements of their study in the context of quantitative and qualitative approaches. This enables them to better understand the priorities that should be given to the two types of research data. Table 3-5 presents the authors high-level consideration of this matter for the current study

Characteristic of Research	Research type required	
	Dominantly Quantitative	Dominantly Qualitative
1) The action research Mode 2 approach necessitates the relationship between researcher and subject matter to be close, using a research strategy that is systematic but less structured than an experiment.		✓
3) Surveys and questionnaires can reveal large amounts of objective, value free quantitative data that could benefit the understanding of disruptive innovation.	✓	
4) Giddens (1987) argues that the phenomenological approach is supported by the collection of primarily qualitative data, as social reality can only be understood through the eyes of the participants involved. This indicates that data collection techniques generating quantitative data will provide value; however, qualitative data collection techniques should be given more weighting.		✓
5) Miles and Huberman (1994) and Silverman (1999) state that qualitative data provides a better source of richness and holism that has a stronger capability for revealing complexity. This closely fits the pursuit of the current research.		✓
6) The relationship between theory and the current research is one of emergence. Such a relationship points to the need for qualitative data (Miles and Huberman, 1994).		✓

Table 3-2: An analysis of the need for qualitative and quantitative data in the current study

Therefore, both quantitative and qualitative research types are appropriate in the context of the current investigation. However, a significant emphasis is placed upon the latter. There are several data collection techniques appropriate to a qualitative collaborative inquiry and researchers must be cautious when using such strategies as they can negatively impact impartiality and generate a prejudice in results. For example, Yin (1994) asserts that a researcher's close involvement with cases under consideration can lead to bias in the data collection and the outcomes of data analysis. Hence, three recognised mechanisms have been identified to help overcome this risk (Yin 1994; Strauss and Corbin, 1990; Eisenhardt, 1989):

a) A series *of semi-structured surveys/interviews* will be conducted with 'expert industrialists' and 'expert academics' *external to the cases under examination.* This data collection and analysis will be implemented in parallel to the multiple case study strategy. *Triangulation* of the findings from these interviews with the case study data will reduce risks of researcher bias.

b) Case study *data* will be drawn from the collaborating organisations, which will be primarily *analysed* via individual *researcher examination.* However, periodic inspections will be conducted by the *collaborating practitioners and other invited organisations.* Once again this will ensure that the researcher has accounted for any accidental bias.

c) *Enfolding the literature* at key points will help with *corroborating internal validity and generality.* For instance comparisons of the emergent concepts/frameworks with a broad range of literature, the use of conflicting literature and similar/supporting literature, will force deeper investigation and iterations between theory and data.

In sum, at the onset of the current research a predominantly phenomenological perceptive was adopted, with the purpose of exploring and describing the nature of disruptive innovation and how it can be enabled by today's management practitioners. A multiple case study and survey strategy was selected in line with the Mode 2 approach. Three waves of researcher led collaborative data collection and analyses were conducted. The first two waves were focused upon inductive theory building and the collection of primarily deep and rich qualitative data. The final wave will also include a deductive approach with some quantitative data collection (Figure 3-4). Exactly how this strategy was employed, in terms of data collection, data analysis and ensuring research quality, is

outlined in the following sections (Appendix 2 provides further details concerning research strategies (e.g. experiments, surveys and case studies), how they were selected (e.g. consideration of the type of research questions and the control required over events etc.) and how decisions were made regarding research focus in terms of quantitative or qualitative data collection).

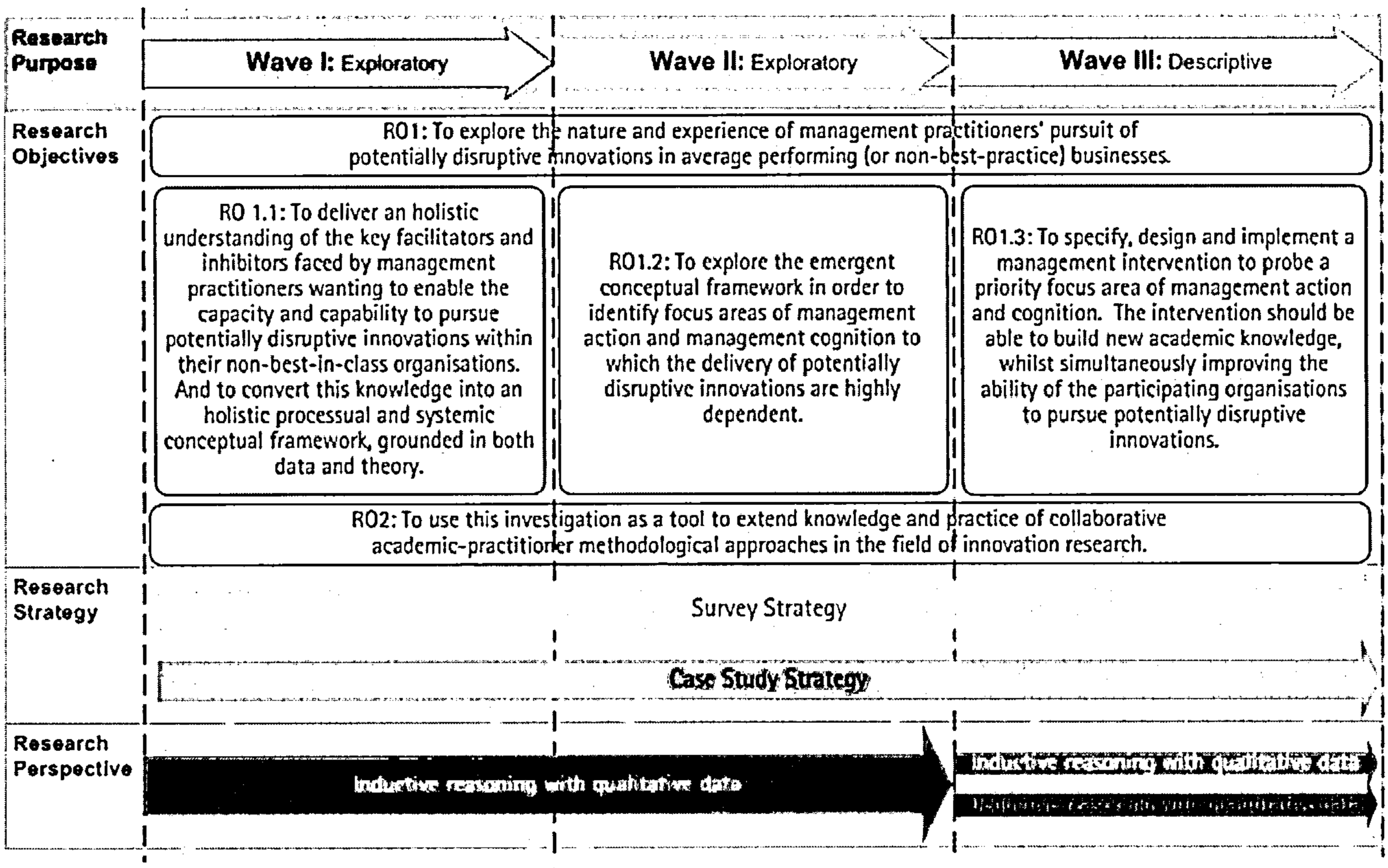


Figure 3-4: High-level summary of research strategy

3.3.1 Implementing a Mode 2 multiple case study and survey strategy

Chapter 3 and Appendix 2 have thus far shown how a multiple method research strategy was selected; focused upon the use of case studies in a collaborative academic-practitioner approach to deliver new knowledge on the topic of disruptive innovation. Decisions have been presented upon the qualitative nature of the study; however, the precise details of research activities have thus far

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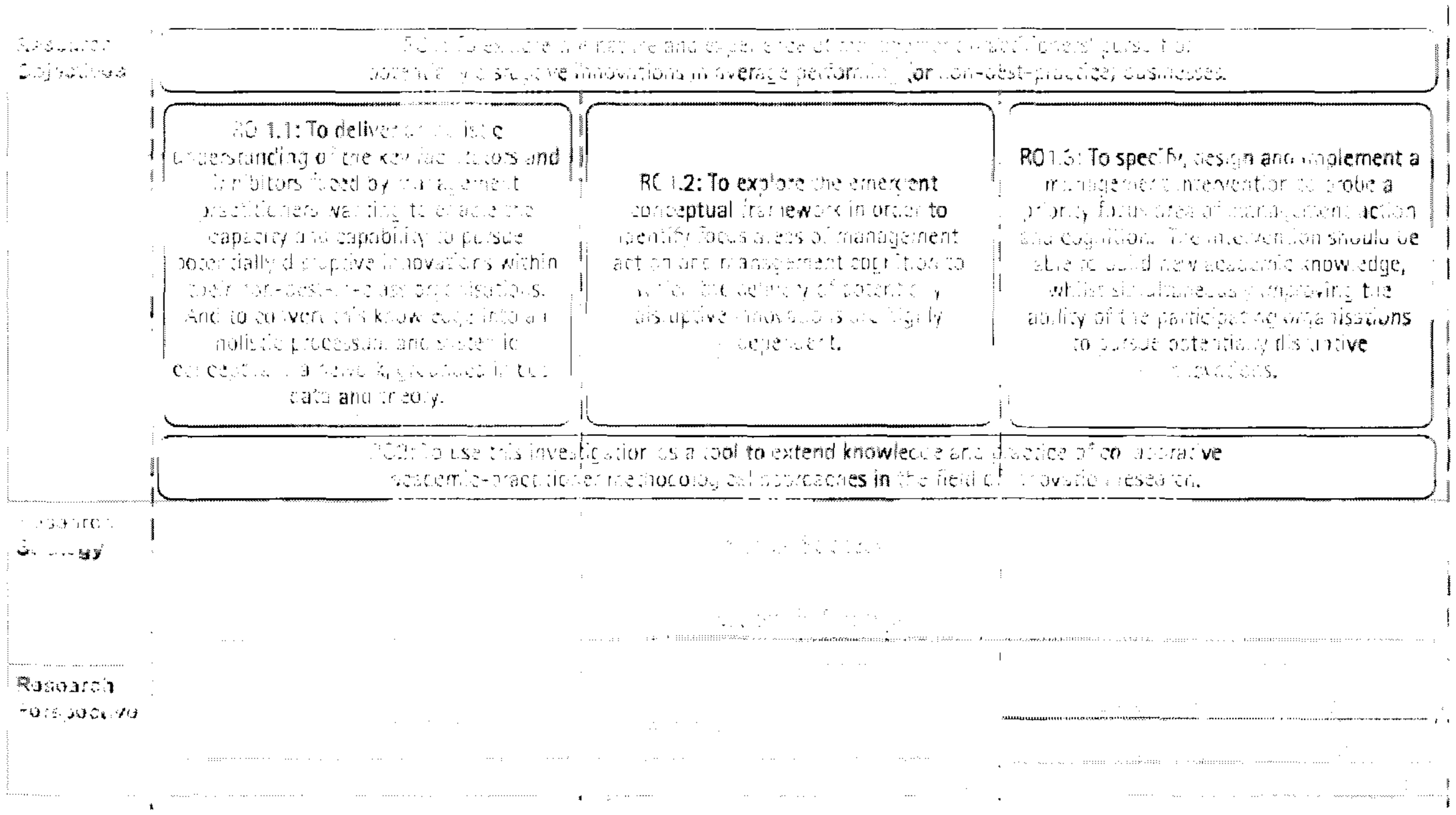

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not been offered. What ensues is a high-level summary of how the detailed design of the investigation took place, followed by a presentation of the activities – such as data collection and analysis techniques, case selection etc. - that have been pursued by the author.

As previously stated, it was decided that a significant deliverable of the primary use of case studies in a collaborative academic–practitioner approach, should be an holistic conceptual framework of disruptive innovation. Eisenhardt's (1989) and Yin's (1994) seminal work offers guidelines for using case study based strategies, advice on data collection and analysis, and guidance for knowledge and theory building using such methods. They also provide insights for researchers wishing to conduct collaborative academic–practitioner investigations. Moreover, Eisenhardt's (1989) work proposes a nine stage process (Figure 3-5) that provides a structure on which a case study strategy can be employed for conceptual framework construction and theory building.

The notion of relating specific data collection techniques with particular research strategies is an unnecessarily tight linkage; instead, multiple collection techniques can be used to great effect (Miles and Huberman, 1994; Silverman, 1999). Therefore Eisenhardt's process, with the utilisation of multiple data collection and analysis techniques, was adopted by the author and adapted with the insights and advice from eminent qualitative research authors, such as Yin (1994), Strauss and Corbin, (1990), Miles and Huberman (1994) and Silverman (1999).

In order to implement the case study strategy in the context of collaborative research, three actions had to be completed before the full design of the research programme could commence (Eisenhardt, 1989). (1) Definition of the tentative research questions and constructs. (2) Selection of appropriate cases and interviewees. (3) Construction of supporting instruments and protocols. These tasks were integrated into the opening steps of the first wave of research activity and once they were completed research activities could be designed, data collection tools selected and data analysis techniques could be constructed

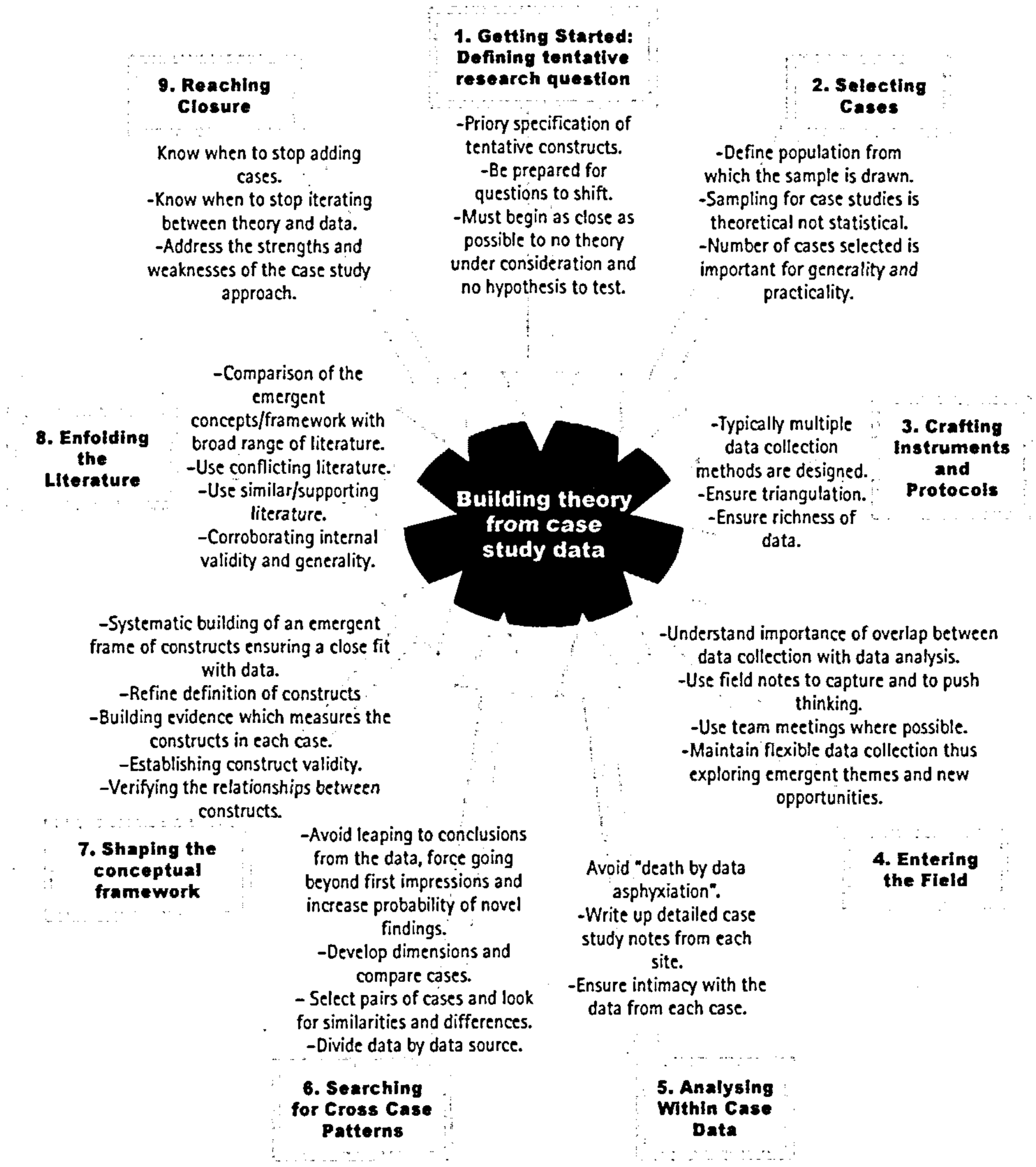


Figure 3-5: Building theory from case study data (adapted from Eisenhardt, 1989)

3.4 Wave I: Delivering research definition and a holistic understanding of disruptive innovation.

The first wave of this research was designed as an exploration to better understand the complex and dynamic phenomenon of the pursuit of disruptive innovation. Over a 15 month period, a series of workshops, interviews and observations were used in an inductive knowledge development cycle. The analyses of the data and the enfolding of literature were extrapolated into a conceptual

framework of enablers and inhibitors that management practitioners face in the pursuit of potentially disruptive innovations. A full description of the collaborative mode 2 methodology is presented in the remainder of this section.

3.4.1 Getting Started: Defining tentative research constructs

Objective
- *To develop tentative research constructs to aid case selection and initiation of inquiry.*

Eisenhardt (1989) suggests that researchers wishing to *build* management theory must begin as close to no theory under consideration as possible. However, in the context of the collaborative research, the author could not approach potential industrial collaborators without what looked like a well defined research focus. Thus, early data collection was guided by the development of initial tentative constructs. Authors such as Eisenhardt (1989) and Robson (1993) suggest that initial tentative constructs can be generated through a simple review of extant literature and discussions of initial concepts with management practitioners from the field.

When initiating this investigation no overarching theory or model could be found on how organisations can foster disruptive innovation. Thus, a research question was established in order to define the research focus. The question was posed within an exploratory research design, which allowed for it to change in accordance with the emergence of new information.

> *"How can senior practitioners understand and foster disruptive innovation as part of a major competitive strategy?"*

This initial phase was conducted in parallel with case study selection (Section 3.5.2) and it quickly became apparent that very few practitioners in potential case study sites were aware of the term disruptive innovation. There was either significant confusion surrounding the meaning or complete ignorance of the phrase. Therefore, it was decided necessary to conduct an extensive literature survey in order help define disruptive innovation and to generate some simple tentative constructs. The tentative constructs were used to guide, but not direct, the author's planning and initial discussions (Figure 3-6 illustrates the key words and terms used to search the broad base of innovation literature).

The specific relationships between variables and theories were not considered in depth so as not to generate preconceptions on how to answer the broad research question. Instead, the survey led to the generation of the research questions and research objectives and enabled the author to frame the term disruptive innovation in a language that practitioners could better understand. Thus,

constructs were formed to help drive the data collection. The results of this initial stage can be seen in Chapter 4.

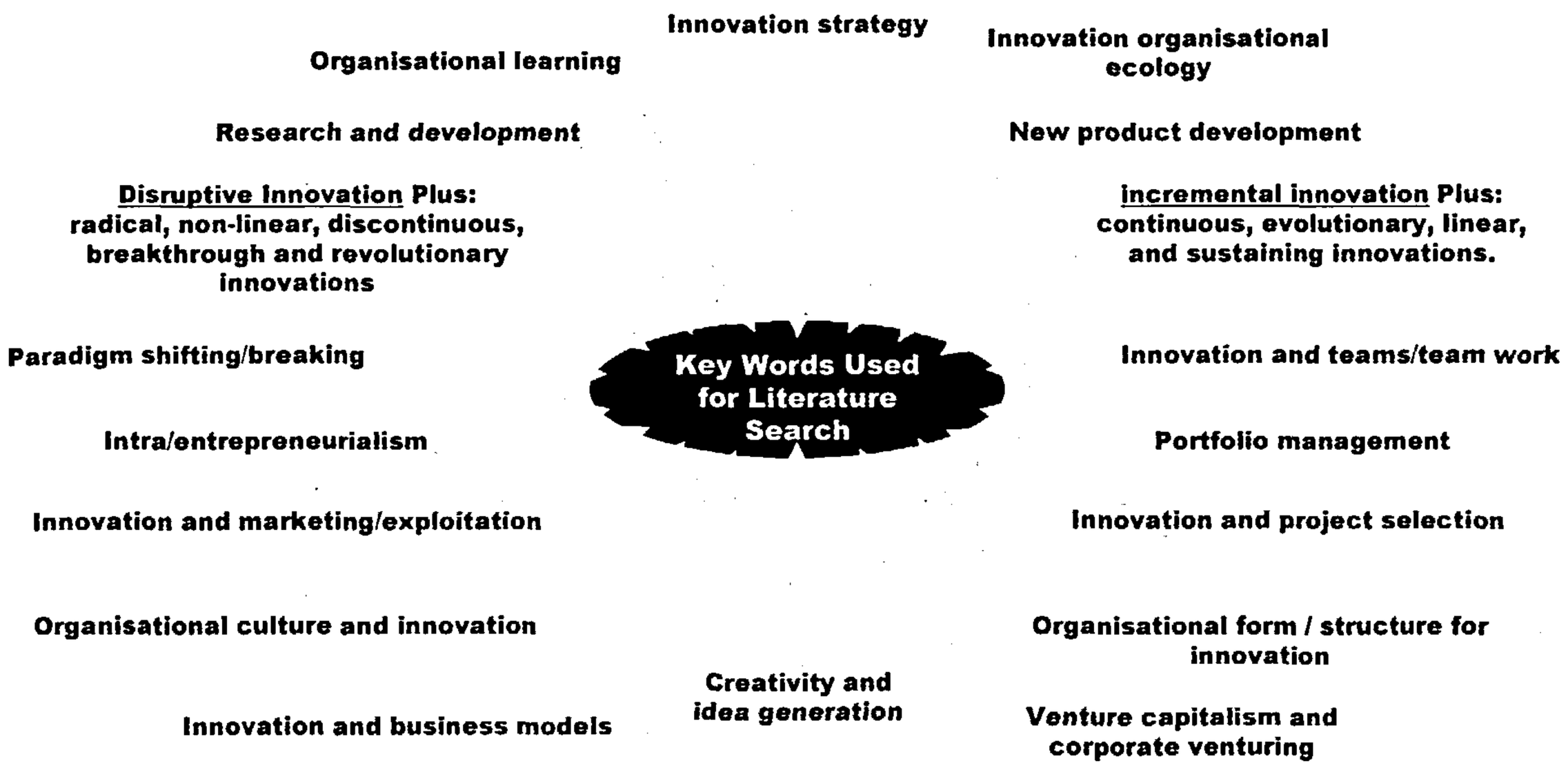


Figure 3-6: The key words/terms used to search literature in the field of innovation management, technology management, marketing, research and development and new product development.

3.4.2 Selecting cases

Objectives

- *To develop case and interviewee selection criteria.*
- *To select appropriate cases to be involved in collaborative research.*
- *To identify interviewees to be involved in survey strategy.*

☐ Why case and interviewee selection is important to the Mode 2 approach

The decision to conduct a collaborative Mode 2 investigation suits the pragmatic demands of industrialists wanting to learn how to improve their chances of fostering disruptive innovation. It also suits the author's personal research style and, more importantly, it helps target existing gaps in academic knowledge. The collaborative approach requires high levels of commitment from both the researcher and the cases involved. Participative firms must be willing to provide appropriate levels of access, so that the problem can be framed in the context of application. And individuals from the organisation must be willing to actively engage in the investigation. Therefore, organisations involved in collaborative research must be carefully selected.

Van Maanen (1988) warns of the problems of "going native" – where researchers become so close to their subjects that they lose their objectivity. Measures must be taken to ensure that the collaborative nature of an investigation does not bias a researcher led inquiry. Thus, it was decided that expert industrialist and academics from outside the research group were to be interviewed to triangulate the findings; both case study organisations and interviewees were judiciously selected.

☐ Selecting the cases for the collaborative Mode 2 inquiry

The concepts of population and statistical sampling are crucial in quantitative research. However, in qualitative studies, sampling (or in the case of this study – case study and interviewee selection) is not based upon statistical reasoning. Instead, the type and quantity of participants selected depends upon theoretical, strategic and pragmatic factors (Yin, 1994; Robson, 2000; Silverman, 1999).

Cases are predominantly chosen for one of two reasons within well designed case study research (Yin 1994; Eisenhardt, 1989; Silverman, 1999):

a) To replicate previous studies in order to extend emergent theory.

b) To fill theoretical categories to generate new theory.

The current research does not aim to replicate previous studies; instead it aims to generate new understanding and theory. Thus theoretical categories based upon the underpinning notions of the topic must be established to focus case study selection.

The premise that disruptive innovation is "a powerful force that sooner or later threatens the health and survival of *all* well-managed companies, and constitutes an extraordinary opportunity [for all industrialists]" (Christensen, 2003:1) looks to remain unchallenged. Although some academics are calling for tighter definitions and more detailed research (e.g. Daneels, 2004), to date, the academic community appears to accept that disruptive innovations can affect any organisation from any sector. The current research does not aim to challenge this premise. Instead it aims to better understand how organisations can foster disruptive innovations. Therefore, when building a framework that attempts to explain how the phenomenon can be fostered it should either have a wide ranging generality, based upon data from a wide ranging sample, or be focused upon one specific type of industry/organisation.

The author was more interested in the wider generality of the topic, which would dictate, within a quantitative study, for data to be drawn from a sample of organisations that represent every facet of industry. Clearly this is impractical for a case study approach and the time restrictions of the current research. Eisenhardt (1989) and Yin (1994) state that when selecting cases it is best to choose a sample that matches the criteria of the extremes of the theoretical categories. Therefore, using the European Commission's definitions of large, *medium* and small sized enterprises (The European Commission, 2002) and the differentiator of service provider versus manufacturer, a 2x2 matrix was generated to help with case selection (Figure 3-7). The matrix represents the expansive range of organisations to which disruptive innovation could be relevant. The embodiment of the broad population aids with the generality demanded by the research topic. It was established to carefully assess the appropriateness of potential cases once the constraints of further theoretical categories, or selection criteria, had been established.

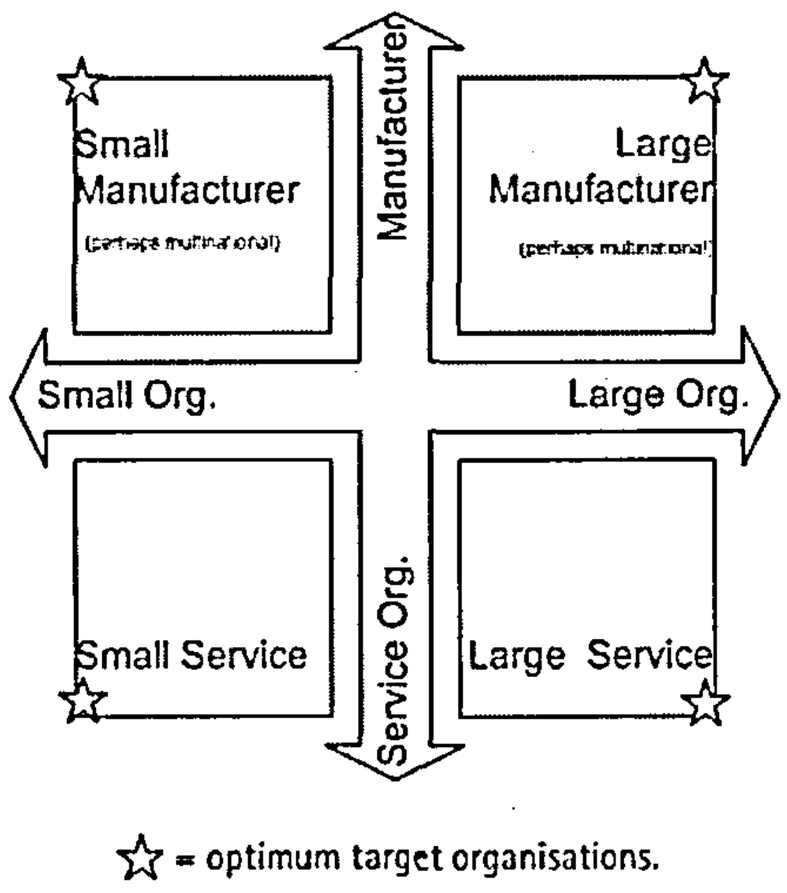


Figure 3-7: The expansive range of organisations to which disruptive innovation could be relevant

When implementing a case study strategy, researchers have to decide on which period in time to focus. For example, they can focus upon data from present and currently occurring activities or they can build an understanding of a past case history, or a balance of both approaches can be struck. Furthermore, researchers can choose to look towards better understanding best-in-class-organisations, average-to-low-performers, or once again a balance between the two can be struck. The author represents these decisions within the context of the current research in Figure 3-8.

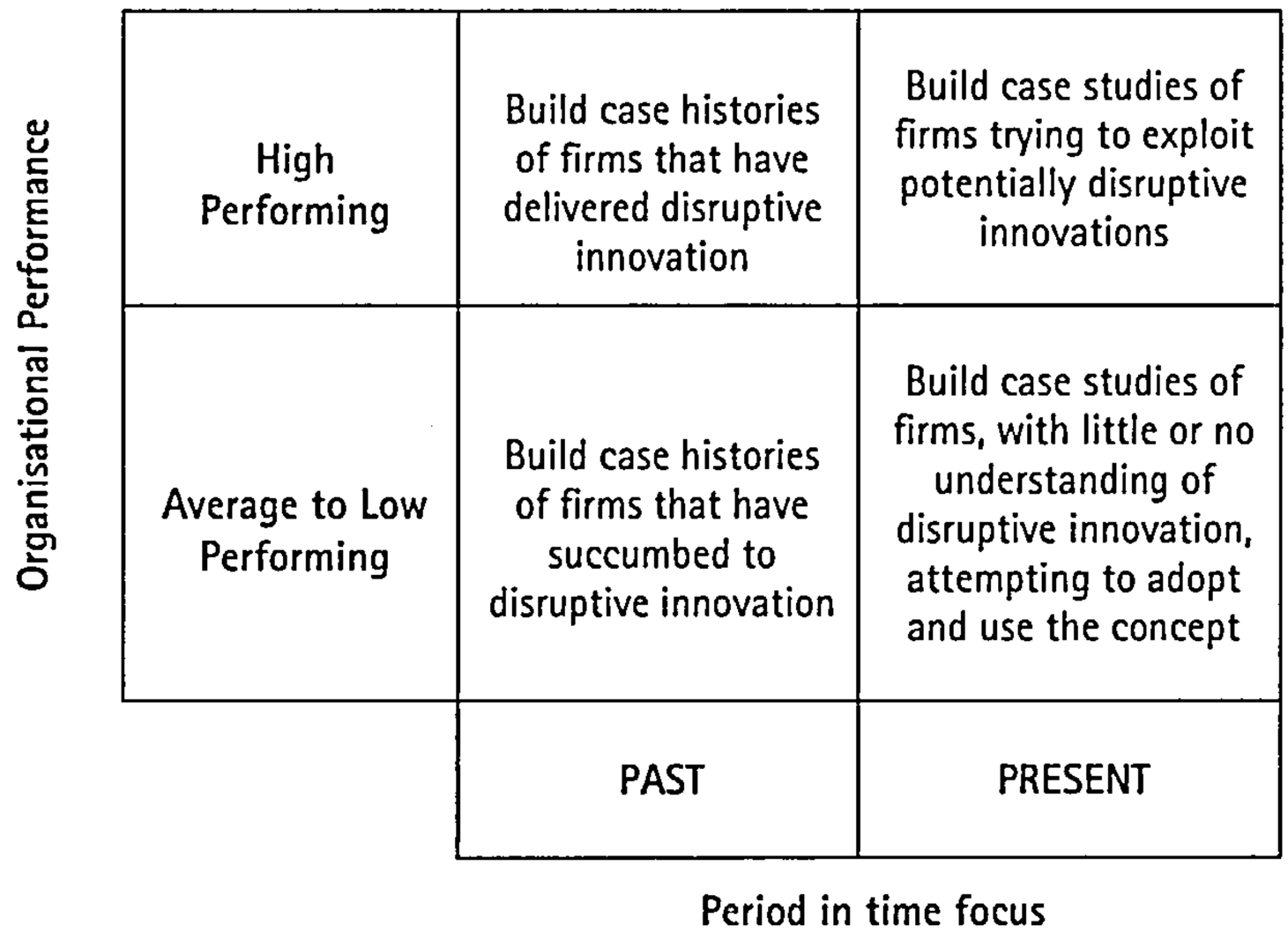


Figure 3-8: Where to focus research activities - period in time vs. organisational performance

Case histories of disruptive innovations are riddled with stories of the winners and the losers and hind-sight analysis in to what went right or wrong. Much of the published literature on disruptive innovation is of this nature. There is a great deal to be learnt about how disruptive innovation can be enabled by looking at the cases of past success stories. Much can also be learnt from studying those who were disrupted; for example, insights into bad practise can be gleaned from stories of practitioners who failed to *see* disruption coming until it is too late. However, in the judgements delivered from the analyses of success and error, hind-sight bias reigns supreme (Kern, 1999; Blaikie, 1993). It is common for humans to construct plausible, linear stories of how failure or success came about once we know the outcomes (e.g. Starbuck and Milliken, 1998), for example making the participants look bad enough to fit the bad outcome they were involved in (Reason, 1997). It can therefore be argued that these reactions to failure or success make after the fact data mining of personal short comings or success factors - real or imagined - not just counter productive but actually untrustworthy (for a discussion on accounts of failures see Dekker, 2001 and for a more detailed commentary upon the weaknesses of assessing historical cases for theory building see Glaser and Strauss (1967) and Blaikie (1993)).

A grounded approach (Glaser and Strauss, 1967; Strauss and Corbin, 1990) to data collection was deemed appropriate, whereby predominantly inductive thinking and analysis would result in the discovery of new theory (see Appendix 2 for further discussion). This approach lends itself to

naturalistic methods (for example, interviews and observations within case studies) based on current or real time data. This avoids the problems associated with historical case analysis, leaving the decision to be made regarding whether 'high-performing' or 'average-to-low-performing' firms are selected. It is believed that this choice lends it self to two types of case study procedure, or a combination of both, for researching disruptive innovation (Figure 3-9).

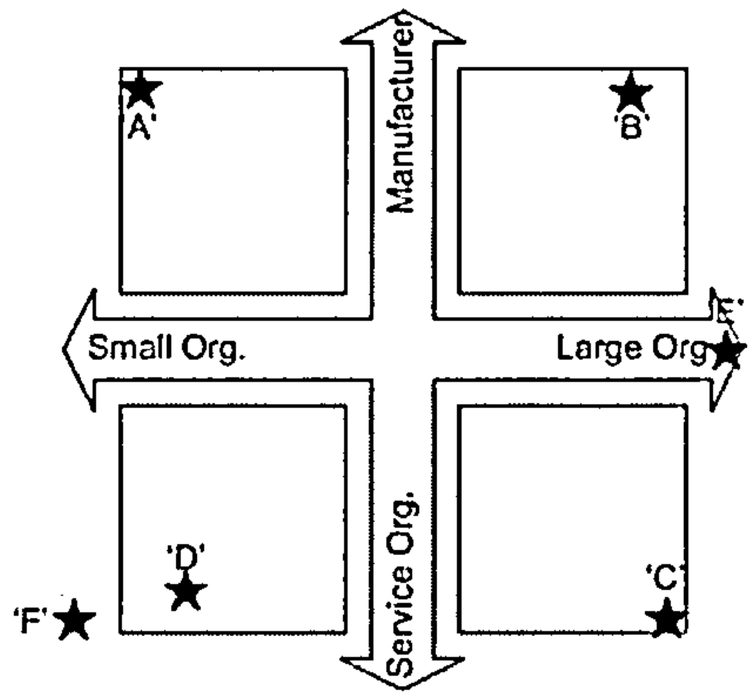
(1) The establishment of a number of longitudinal case studies with best practice innovators.		(2) The introduction of the concept of disruptive innovation into a number firms of an average or more typical innovation performance.
The author could plot the efforts, successes and failures of organisations who believe they have potentially disruptive innovations in their grasp. The analysis of this data would generate further understanding and theory.	Vs	The author could facilitate the co-creation of knowledge and understanding on disruptive innovation. New theory would be generated through assessing observations of the practitioner's ability to adopt the concept and perhaps utilise it to their advantage.

Figure 3-9: Selecting 'high-performing' or 'average-to-low-performing' case studies.

Both these approaches can be used to research disruptive innovation by gathering qualitative data using a variety of naturalistic methods (for example, interviews and observations within case studies). Both would also generate theory with data analysis that uses interpretative procedures. However, due to time and funding issues, the second approach was deemed more appropriate.

Eisenhardt (1989) suggests that it is difficult to generate and justify theory from less than four cases and too difficult for a researcher to cope with the amount of data generated by over 10 cases. Therefore, it was decided that the case study element of the research would focus upon the generation of data from the transfer of the concept disruptive innovation into four disparate non-best-in-class organisations.

The final criterion used in the case selection was access. As the current study aims to better understand how disruptive innovation can be fostered by management practitioners, access to senior and strategic decision makers was deemed essential. The author's investigation contributes to a European Commission co-sponsored project called Disrupt-it. The industrial collaborators involved in the project expressed their interest in adopting the investigative approach and objectives of the current research presented in this thesis. Therefore, each organisation was mapped onto the matrix illustrated above in Figure 3-7 in order to assess their fit to this research and its objectives, the result can be seen in Figure 3-10.



★ = organisations wishing to collaborate in the current investigation

Figure 3-10: Prospective industrial collaborators mapped onto the case selection matrix.

Four of the six possible sites matched the theoretically ideal sample as set out by the case selection criteria above. Although a number of the organisations had either delivered highly radical or discontinuous innovations in the past, they now considered themselves to be delivering typical innovation performance for their industry (see Appendix 3 for a full description of the cases). Thus the following organisations form the sample of case studies used in the current study:

- Case A - a small French plastic mouldings manufacturer, primarily producing bicycle helmets.
- Case B – Israel's largest industrial concern, primarily involved in the manufacture of military aircraft and associated defence equipment (with increasingly large and in some sites dominant non-military commercial activities).
- Case C - a Swedish multi-national service organisation operating in the finance sector.
- Case D – a small to medium sized Spanish service organisation offering product design and design consultancy solutions.

Although cases have not been developed for the outlying organisations (Case E a global information technology service organisation and Case F a small Israeli management consultancy) they have still been involved in the investigation but to a lesser extent.

Each case organisation granted frequent high-level access to their businesses including regular contact with at least one strategic level manager and one other senior member of staff (although in practise significantly more people have been involved in the research). Consequently, a

heterogeneous group of senior industrialists was formed to be involved in a researcher-driven collaborative investigation into the term disruptive innovation.

The simultaneous appearance of the four features that typify the Mode 2 approach to research (Stewart et al., 2000) had been achieved. Firstly, the initial research problem 'how can senior practitioners understand and foster disruptive innovation as part of a major competitive strategy?' was framed in the context of application (as was the later refined research question). Secondly, a heterogeneous group of both academics and practitioners were engaged in the investigation of disruptive innovation, using a trans-disciplinary approach. Thirdly, the group had agreed to adopt a socially-distributed research capability; and finally, theory-building and application were to be combined in the co-production of new knowledge.

☐ Selecting the expert interviewees for data collection outside the collaborative inquiry

The industrialists involved in the collaborative aspect of the research requested, in return for their involvement, that they would gain *state of the art* insights and advice from academia and 'best practice' organisations. As part of the collaborative nature of the research this steered the selection of interviewees. Therefore, similar selection criteria were adopted when establishing contact with prospective interviewees - except for one feature. Interviewees had to be involved with organisations that were considered to deliver 'best innovation practice' as perceived by the collaborating industrialists. In total seven interviews were completed with industrialists and three with leading British academics (Figure 3-11 and Table 3-2).

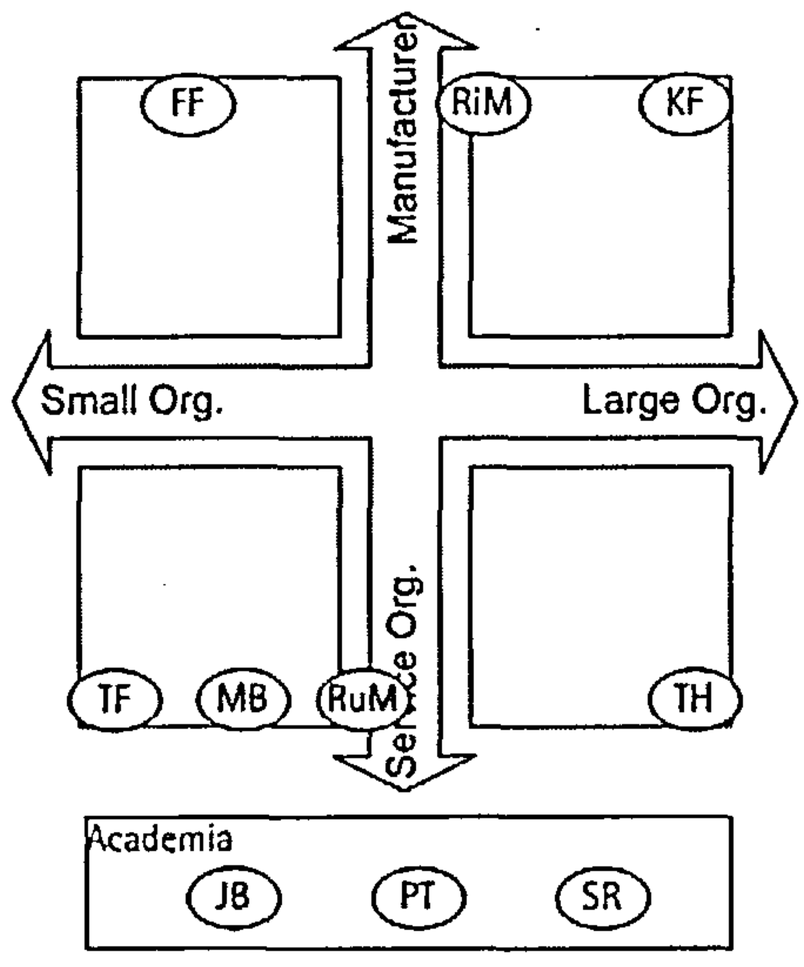


Figure 3-11: Interviewees contributing towards the current research by organisational size and customer offering.

Interviewee Identifier	Role and Organisation.
KF	Commercialisation Director - national world leading organisation based in the aeronautics and space industry.
RiM	Director of Technology - Europe's leading manufacturer based within computer printer industry.
FF	Chief Executive Officer - world leading national semiconductor manufacturer.
TF	Director (and Founder) - Leading small UK management and product design consultancy and research foundation.
MB	European Head of Human Factors - world leading multinational product design consultancy.
RuM	Director of Innovation - fastest growing multinational advertising and media company.
TH	Senior Innovation Team Consultant - Europe's leading multinational mobile telecoms organisation.
JB	Professor and author on innovation management.
PT	Senior Lecturer and author on new product development.
SR	Professor and author on regional innovation networks.

Table 3-3: Interviewees contributing towards the current research by role and organisational description.

3.4.3 Crafting instruments and protocols: building collaborative working practice to deliver holistic understanding.

Objectives

- *To create an environment of openness as an instrument for collaboration and knowledge sharing.*
- *To construct protocols and tools to facilitate the co-development of construct equivalence and new knowledge within the team.*
- *To deliver a research programme owned equally by the practitioners and the author.*

Mintzberg (1979) acknowledges that it is possible to uncover all kinds of relationships in hard data; however, he states that it is only through the use of soft data that we are able to explain them. Thus, theory building requires rich description. Gibbons et al. (1994) support this notion and adds that successful collaborative research is "...characterised by a constant flow back and forth between ... the theoretical and the practical... discovery occurs in contexts where knowledge is developed and put to use, while results, which would have been traditionally characterised as applied - fuel

further theoretical advances" (Gibbons et al., 1994:9). Therefore, the need for the collection of rich data in a collaborative setting inspired the development of a cyclical data collection and inductive data analysis process (Figure 3-12).

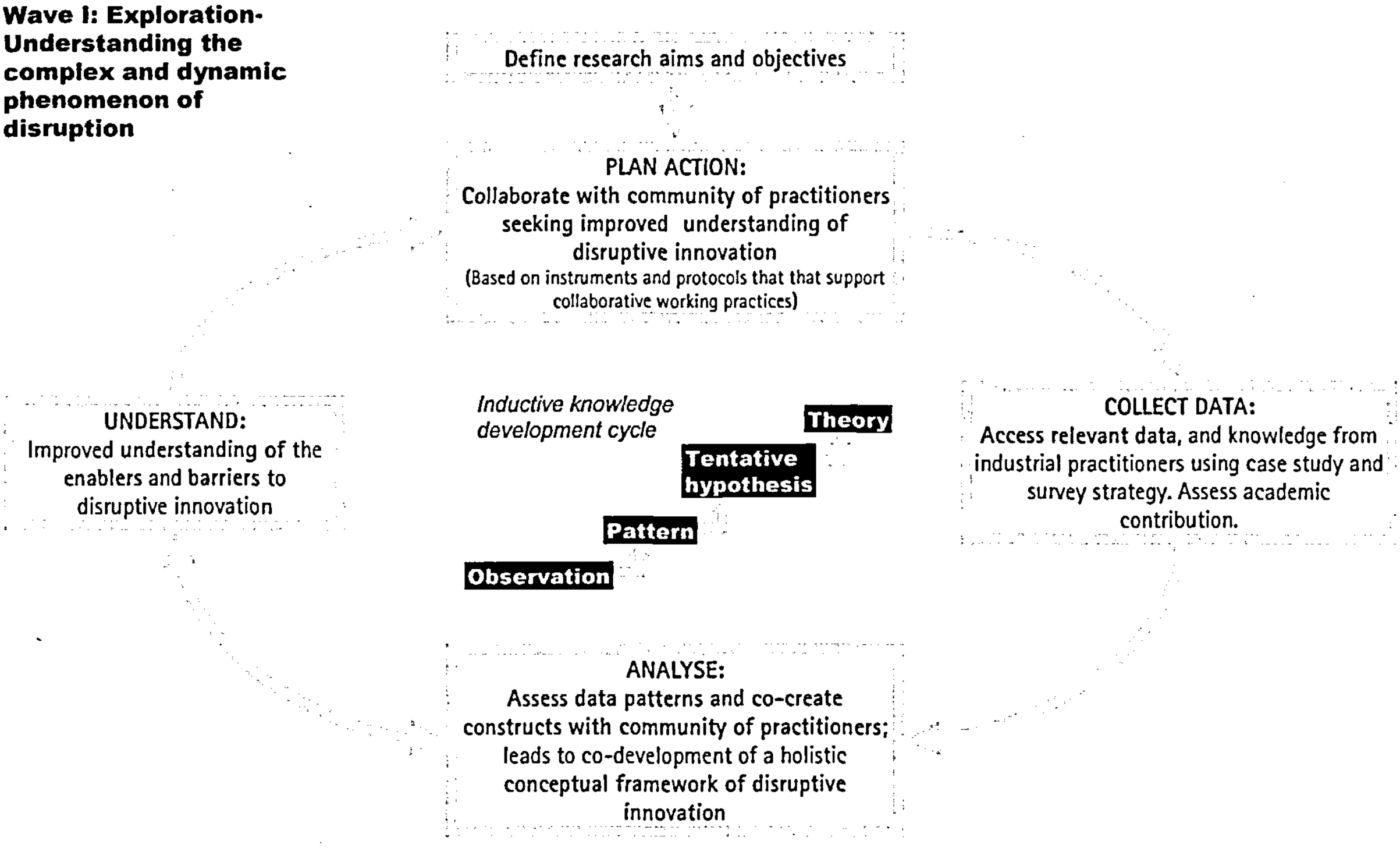


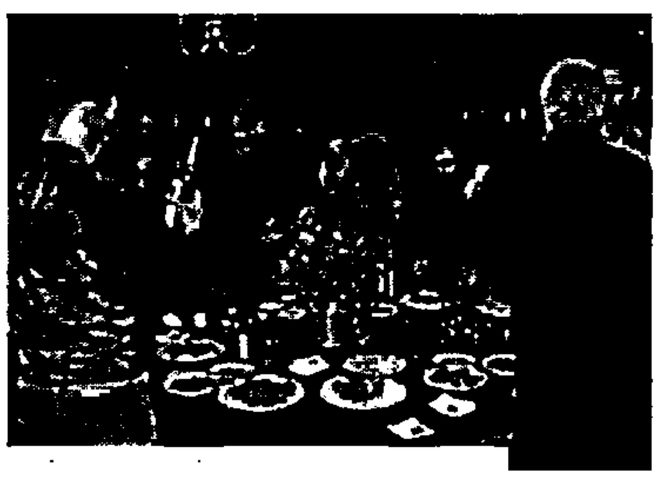
Figure 3-12: The researcher driven, collaborative, inductive-learning approach used in the first wave of the research.

The problem, however, with exposing and assessing soft data in a collaborative setting involving more than one party is that meanings are open to interpretation and emphases can be misunderstood (Antaki, 1988). Antaki (1988) shows that there is often incongruence between researchers' and respondents' definitions of actions, explanations, resources and competencies, an issue that Welkenhuysen-Gybels and Van de Vijver (2001) refer to as the level of *construct equivalence*. Where there is a high level of construct equivalence, different parties have identical or at least very similar understandings of the terminology in use. In situations of low equivalence the opposite is true; this is often the cause of disagreement and conflict within groups (Arnold et al., 1998; Warr, 2002). Thus, every day explanations for everyday events are open to interpretation by different people; this issue is often exaggerated when parties are from diverse backgrounds, different countries and different cultures (Antaki, 1988).

Hence, it was essential that the research team achieved a high level of construct equivalence on key terminology as early as possible. Furthermore, an environment had to be fostered in which all participants felt comfortable to expose their ignorance of new terminology and where they felt free to openly discuss disagreement with definitions or misunderstandings. An environment of trust and openness helps to alleviate the problems associated with low construct equivalence and provides an environment that facilitates rapid understanding of new concepts (Arnold et al., 1998; Warr, 2002). Thus, to conduct effective collaborative research three features were deemed necessary:

- The creation of an environment of openness as an instrument for knowledge sharing.
- The construction of protocols and tools to facilitate the co-development of new understanding and construct equivalence within the team.
- A research programme owned equally by the practitioners and the author.

☐ Ensuring trust and openness to facilitate the collaborative approach

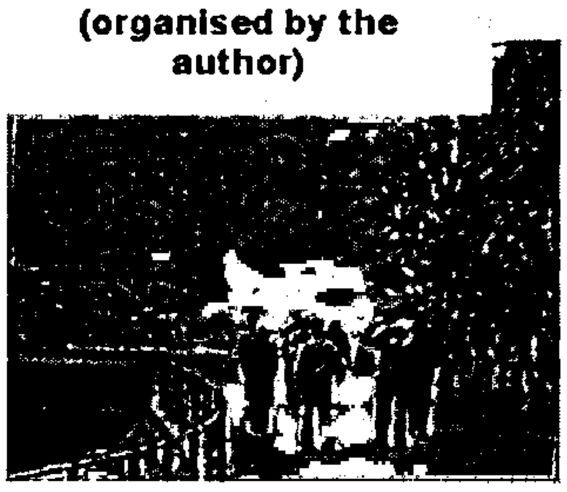


Wine tasting and 'tapas' (organised by Case D)

Developing innovation cartoons (emerged from a group exercise)

Examples of team building to assist the collaborative approach

Team walks – before during and after project meetings (organised by the author)



Team building – games and puzzles (organised by D)

Figure 3-13: Developing a supportive environment for collaborative research.

The research design, as will be shown later in this chapter, required the participants to share personal thoughts and company practice on innovation in open data collection workshops. Thus,

for the researcher driven collaborative approach to be effective, the industrialists were required to be trusting and open both with the researcher and the whole team of industrial practitioners. To deliver the appropriate supporting environment, a number of team and trust building activities were proposed and implemented by each of the different organisations within the group; the essential trust that was required quickly formed (Figure 3-13).

☐ Delivering construct equivalence: A common team understanding of important terminology

Novel insights, such as disruptive innovation, harvested from cutting edge investigations are often met with resistance and fear by those unfamiliar with the subject (Guffey and Nienhaus 2002; Arnold et al., 1998; Warr, 2002). These reactions can prevent knowledge from being transferred and adopted, especially in diverse groups where the participants personally hold different meanings for the terminology involved. In fact, at the onset of the research, the author found that the transfer of novel insights, from disruptive innovation to the practitioners collaborating in the research, was met with further suspicion when:

- The evidence and insights are radical and counterintuitive.
- The existing models involve, as they do with the topic of disruptive innovation, reasonably new and partially incomplete concepts, which use undefined 'fluffy' terminology.
- Evidence is based upon cases and stories that are potentially tarnished by the bias of hindsight.
- Evidence has been taken from often obscure unfamiliar industries.

Therefore, to transfer the meaning of the term disruptive innovation to the research group it was found necessary to generate ownership of the phrase. To do this an instrument was employed know as *graphical facilitation* (Young, 2003).

The protocol used in graphical facilitation is to drive focused group discussion via the illustrative representations of conceptual synthesis and knowledge upon large-scale graphical templates (Young, 2003). The graphical templates are also used to encourage and capture the results of discussion and feedback from all parties in a workshop setting. If implemented correctly, they

generate two-way connections between *all* workshop participants, including the academic and industrial communities. They surface a common language within the research group and prevent dominant people from overpowering group exercises. An essential part of closing a graphical facilitation process is building a summary of the lessons learnt and the actions to be taken. These are also recorded with the graphical method (Figure 3-14), which allows the team to see the details in a holistic manner and enables the group to reach consensus and public commitment to moving the research forward.

Graphical facilitation was used in the opening workshop of the research programme. The method enabled discussions to involve the entire research group and resulted in the co-creation of a working definition of disruptive innovation for the research programme. Once high level construct equivalence had been achieved on this term (comprehension of the terms meaning and impact agreed), it was easier to initiate the investigation into the topic.

The graphical facilitation instrument was so effective in the opening workshop of the research programme, that it was adopted as the primary instrument by which all data collection exercises were conducted or facilitated.

Figure 3-14: Recording the lessons learnt using the graphical facilitation process.

☐ A research programme owned equally by the practitioners and the author

The phased strategy was agreed by the practitioners; resources and a 30 month timetable were allocated to complete the three waves of investigative action. Table 3-3 summaries the research activities and Figure 3-15 illustrates how the programme of research pieces together (note that some activities begin in one wave of research and finish in the next)

Table 3-3: A summary of the research activities in this study

Wave	Activity Name and *Objectives*
Wave I	1. Getting Started: Defining tentative research questions and constructs • *To develop tentative research constructs to aid case selection and initiation of inquiry.*
	2. Selecting Cases for Waves I & II • *To develop case and interviewee selection criteria.* • *To select appropriate cases to be involved in collaborative research.* • *To identify interviewees to be involved in survey strategy.*
	3. Crafting Instruments and Protocols: Building collaborative working practice to deliver holistic understanding • *To create an environment of openness and trust as an instrument for collaboration and knowledge sharing.* • *To construct protocols and tools to facilitate the co-development of construct equivalence and new knowledge within the team.* • *To deliver a research programme owned equally by the practitioners and the author.*
	4. Entering the Field: Wave I • *To conduct multi-organisational, multi-level, multi-functional data collection workshops, where best practise academic insights are shared with practitioners to invoke discussion, feedback and insights into current practice within the cases.* • *To conduct case study site visits to observe their innovation environments.* • *To conduct interviews with 3 innovation experts, 1 from industry and 2 from academia.*

- *To maintain extensive field notes throughout the process.*
- *To ensure synchronous data collection and data analysis.*
- *To maintain flexibility in order to deliver controlled opportunism*

5. Analysing Within Case Data: Wave I
   - *To become intimately familiar with each case as a stand alone entity.*
   - *To allow the unique patterns of each case to emerge before the push to generate theory.*

6. Searching for Cross Case Patterns: Wave I
   - *To use the perspectives of multiple practitioners to analyse data and search for patterns across all four cases.*
   - *To look for similarities and differences, both within and across the cases, using dimensions drawn from the literature on disruptive innovation.*
   - *To break simplistic frames and generate a deeper understanding by juxtaposing cases with apparently similar elements and forcing a search for differences.*
   - *To develop initial framework or theory.*

7. Building a conceptual framework
   - *To solidify the emerging frame and tentative relationships into a testable and verifiable conceptual framework using consolidated bases of evidence.*

8. Enfolding the Literature
   - *To strengthen and enhance or reconfigure and challenge the emerging framework by assessing it with a broad range of conflicting and supporting literature.*

9. Reaching Closure of Wave I
   - *To ensure enough case data has been collected.*
   - *To stop iterating between academic theory and practitioner data at an appropriate time.*
   - *To create feedback for instruments and protocols for next wave of activities.*

10. Crafting Instruments and Protocols: Building collaborative working practice to identify focus areas from the conceptual framework
    - *To construct protocols and tools that will facilitate the identification of focus areas within the emergent framework of disruptive innovation.*

Wave II
- *To maintain the commitment to the collaborative research and the ethos of openness and trust.*

11. Entering the Field: Wave II
    - *To conduct multi-level, multi-functional data collection workshops within single case and multi-organisational settings, in order to elicit focus areas from the framework and to discover how practitioners envisage overcoming the major challenges of disruptive innovation.*
    - *To present to the collaborating industrialists the results of an investigation into 'innovation enabling tools', in order to provoke discussion, debate and further insights into the*

focus areas.

- *To conduct interviews with 3 innovation experts, 2 from industry and 1 from academia.*
- *To maintain extensive field notes, ensure synchronous data collection and data analysis and flexibility to deliver controlled opportunism throughout the process.*

12. & 13. Analysing Within Case Data and Searching for Cross Case Patterns: Wave II

- *To become intimately familiar with the focus areas of the conceptual framework of disruptive innovation as identified by each case.*
- *To use the multiple perspectives, dimensions and case pairing to generate a deeper understanding, in order to identify one focus area upon which the participants from all four cases are keen to prioritise in the final wave of the research.*

14. & 15. Shaping Focused Areas of Framework and Enfolding the Literature

- *To sharpen, refine and define the emergent focus areas by using case data and survey data to build a base of evidence for each dimension.*
- *To strengthen and enhance the emergent focus areas with a broad range of conflicting and supporting literature, paying particular attention to the prioritised focus area.*

16. Reaching Closure of Wave II

- *To stop data collection at an appropriate time.*
- *To create a specific research focus for the third wave of the investigation based upon the prioritised focus area.*

17. Crafting Instruments and Protocols: Building collaborative working practice to test theory generated about the top priority area of conceptual framework

- *To develop a schedule of activity, whereby iterative feedback between the author and industrialists results in the construction of an intervention to test the research hypotheses.*

Wave III

- *To develop a schedule of activity to implement the intervention and to employ data collection tools, such as questionnaires, structured interviews and independent observations.*
- *To consider the authors impact as a participant-observer and to mitigate for negative affects.*
- *To agree mechanisms whereby a contribution to knowledge can be asserted and a contribution to industrial practice can be demonstrated.*

18. Selecting Cases for Wave III

- *To develop case and interviewee selection criteria.*
- *To select appropriate cases to be involved in the final stage of the collaborative research.*
- *To identify interviewees to be involves in survey strategy.*

19. Entering the Field: Wave III

- *To conduct two participant-observer intervention workshops in order to probe the prioritised focus area.*

- *To employ multiple forms or data collection tools in order to both collect evidence regarding the prioritised focus area and the effectiveness of the management intervention.*
- *To conduct interviews with four innovation experts from industry in order to mitigate against 'going native'.*
- *To maintain extensive field notes, and to ensure synchronous data collection and data analysis with the flexibility to deliver controlled opportunism throughout the process.*

20. Analysing Within Case Data: Wave III

- *To become intimately familiar with each case as a stand alone entity with the use of extensive field notes and feedback from other data collection techniques.*

21. Searching for Cross Case Patterns: Wave III

- *To conduct cross case analysis and search for patterns.*

22. & 23. Validating the priority area of framework and enfolding the Literature

- *To assess and refine the emergent constructs, dimensions and conclusions, regarding the prioritised focus area, with supporting and challenging insights.*
- *To strengthen and enhance the emergent dimensions of the prioritised focus area with a broad range of conflicting and supporting literature.*

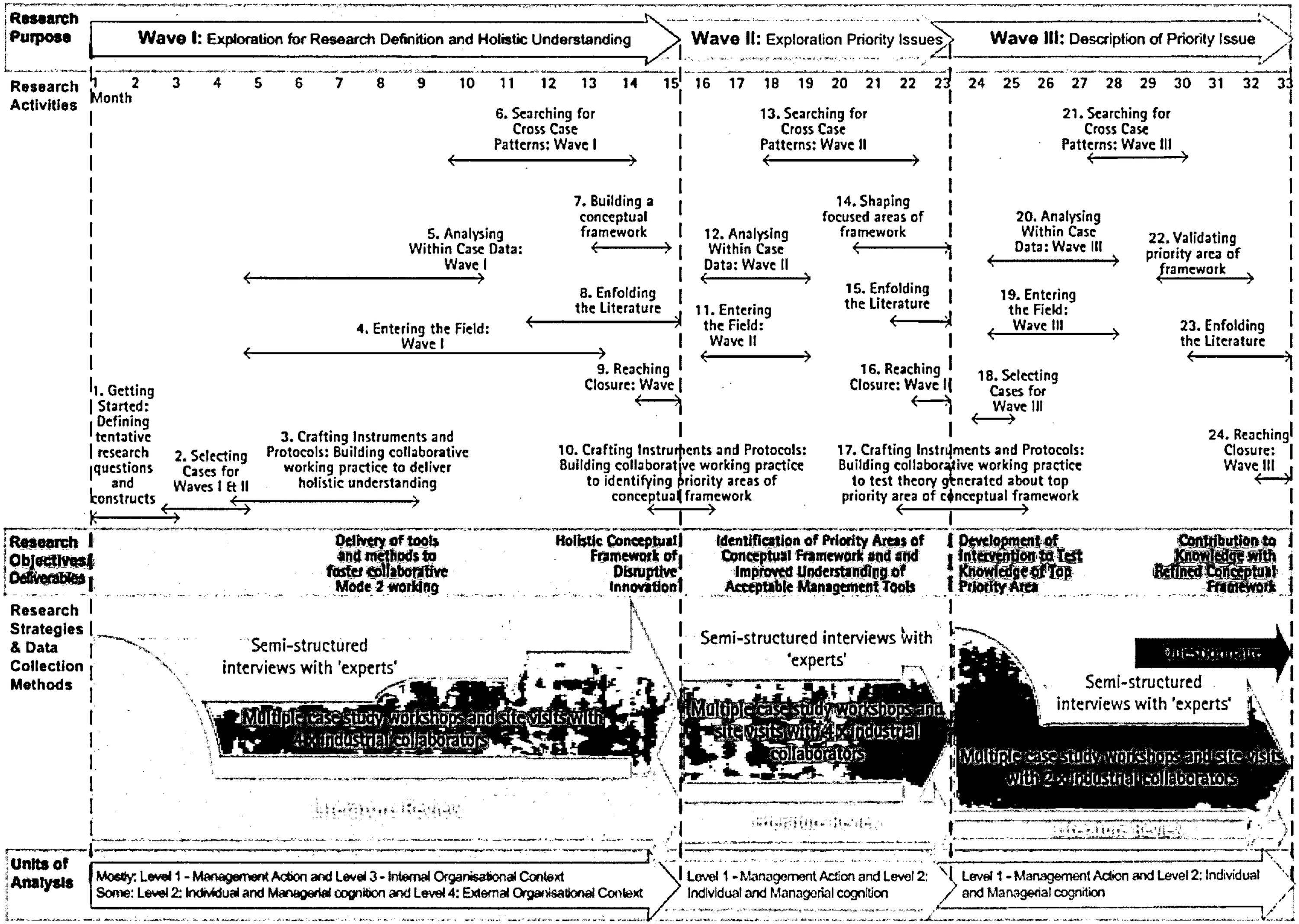
24. Reaching Closure: Wave III

- *To ensure enough case data has been collected.*
- *To know when to stop iterating between academic theory and practitioner data.*
- *To develop and employ mechanisms by which the industrial utility of the investigation's findings can be accepted or rejected.*
- *To address the strengths and weaknesses of the approach.*

Table 3-4: A summary of the research activities in this study.

It is believed that the resultant strategy and research activities have delivered results that satisfy the current research objectives, generating a lucid contribution to knowledge on the topic of disruptive innovation. What follows is a description of the three waves of research activity, illustrated in Figure 3-15. Each step will be described and justifications for the choice of data collection and analysis methods will be presented throughout.

Figure 3-15: The research strategy and activities employed by the current investigation.



3.4.4 Entering the field: Case studies

Objectives

- *To conduct multi-organisational, multi-level, multi-functional data collection workshops, where best practise academic insights are shared with practitioners to invoke discussion, feedback and insights into current practice within the cases.*
- *To conduct case study site visits to observe their innovation environments.*
- *To maintain extensive field notes, ensure synchronous data collection and analysis and deliver controlled opportunism throughout the process.*

The first wave of the current research was conducted over a 15 month period. During this time author facilitated a total 3 three-day and 3 two-day cross-functional, multi-level and multi-organisational workshops with the four case study organisations (each taking turns to host the meetings). The workshop setting provided this investigation with 21 participants from the four organisations with a total of 15 days of discussions regarding their innovation and research and development activities. In addition, interviews were conducted with one member of the executive management team from each organisation and four innovation experts external to the research group (two industrialists and two academics). Throughout these 15 months countless informal email and telephone conversations were conducted regarding innovation and the pursuit of disruptive innovation, this supplied further richness to the data collection.

Robson (1993); Yin (1994), Silverman (1999) and Eisenhardt (1989) place major importance on the researchers approach to 'entering the field'. In accordance with the approaches recommended by these authors the current investigation has placed emphasis on the following factors throughout all three waves of the research design:

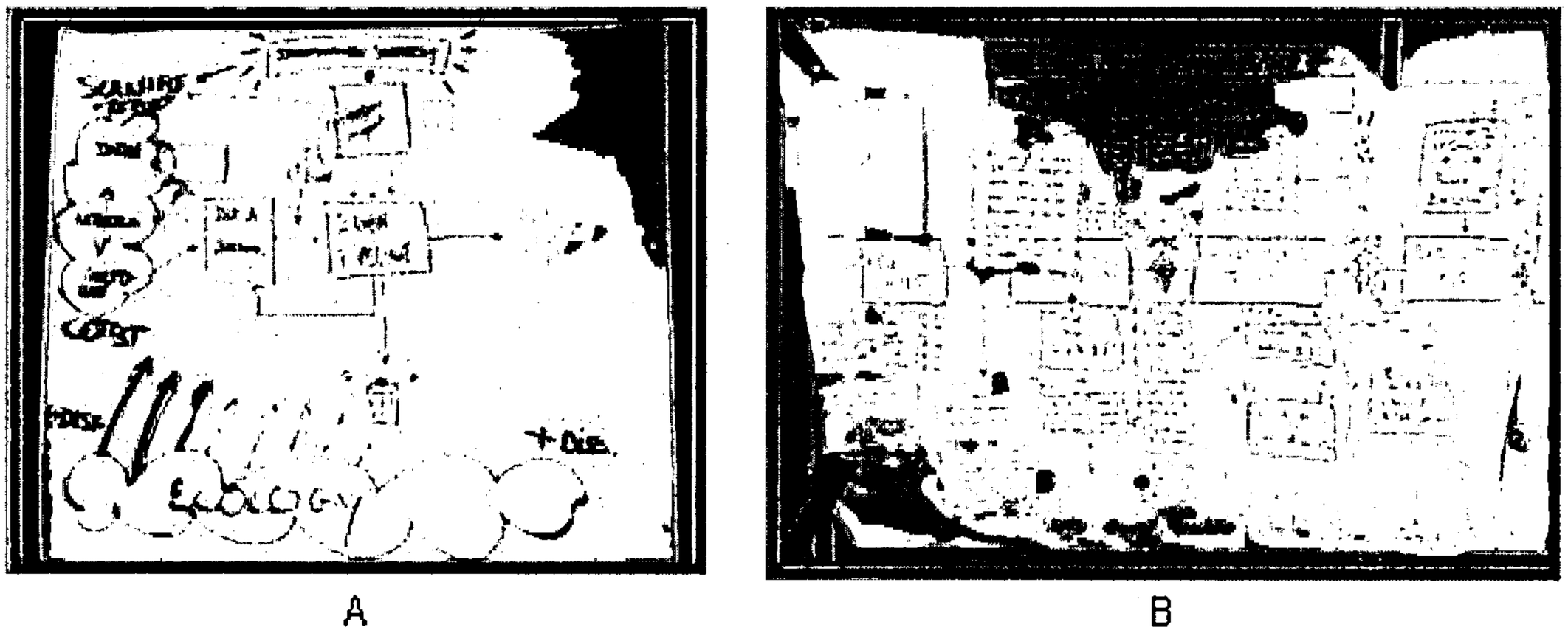
- The use of field notes
- The essential practice of overlapping data collection and analysis.
- Maintaining flexibility in order to deliver controlled opportunism.

During this the first wave of the research, five tentative constructs on disruptive innovation (formed following a review of the literature and initial conversations with industrialists) were used to elicit information from both the practitioners in all four cases and the expert interviewees.

☐ The use of field notes

Extensive field notes were made during *all* workshops; two methods were employed, these have been proposed as suitable and applied in similar contexts by Snowden (2001). The first method, a form of graphical facilitation, is that of a 'story-board' or large-scale graphics. This technique

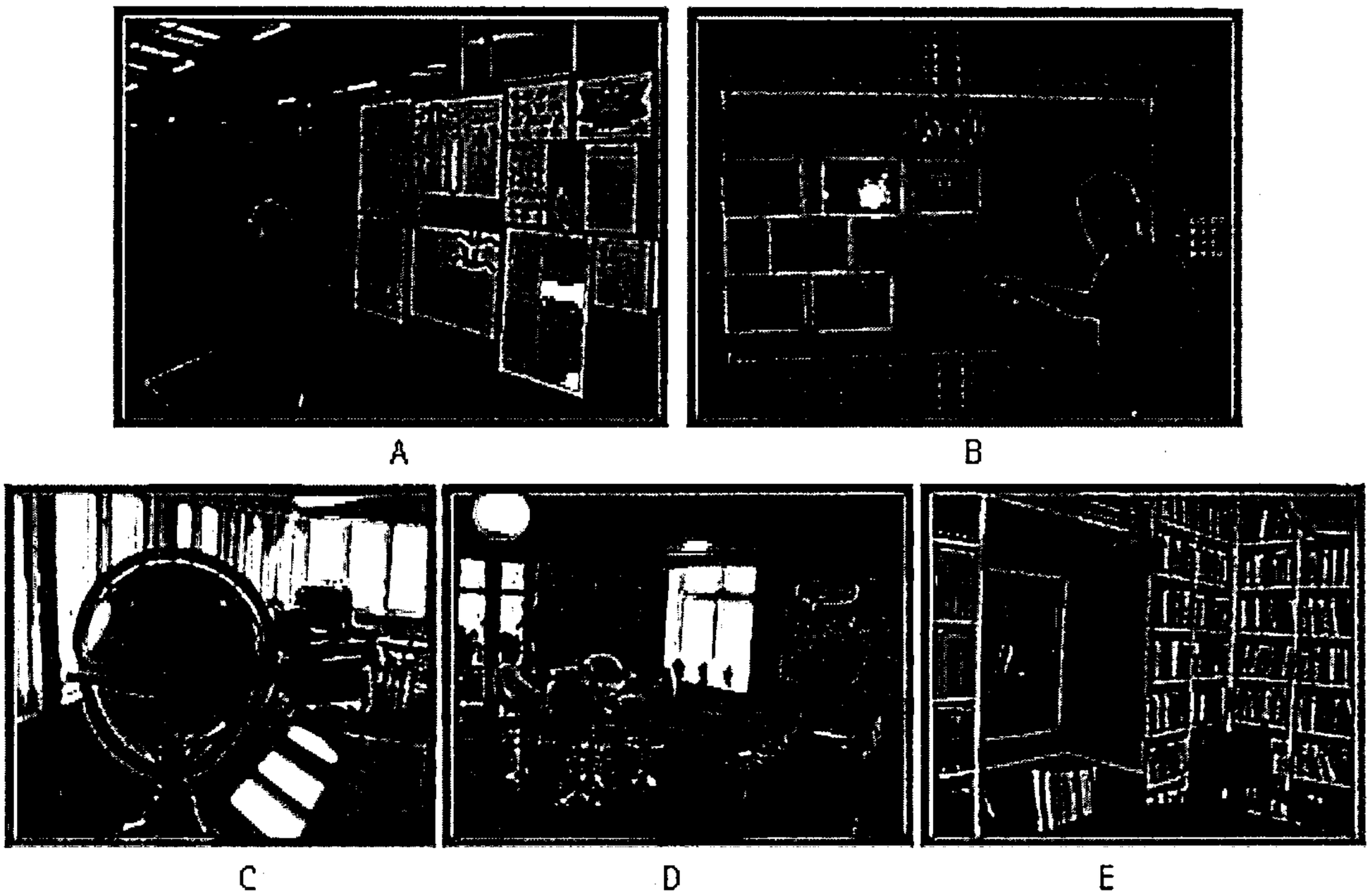
allowed either the author or the industrialists themselves to capture, via illustrations, the innovation processes, stories and/or concepts that were discussed and presented (Figure 3-16).



A = Storyboard capturing Case D's vision of how they would like their innovation process to work.
B = Case B's complex and busy innovation process drawn by an innovation team manager and a senior engineer

Figure 3-16: Examples of 'story-board' illustrations of two innovation processes captured in the workshops

Along side the graphical technique a diary of field notes was kept using the split-page field note technique (Snowden, 2001), which allowed the author to build a "stream-of-conscious commentary" (Van Maanen, 1988:56) about what was happening. Each page of notes was divided into two columns; the first column was used for collecting direct observations of occurrences in the field. It is vital to react rather than sift as it is difficult to know what may be important in the future. The second column is used to push thinking; it captures ideas and thoughts from on-the-spot analysis. This is often generated by continually "...asking questions such as 'What am I learning?', 'What is different from the other cases?'" (Eisenhardt, 1989: 539). The separation of observation and the on-the-spot analysis helps to prevent researchers from allowing their thoughts to bias their observations, whilst not losing the richness of the analysis (Snowden, 2001) (examples of field note output from the current investigation can be seen in appendix 2). Photographs of the industrialists' working innovation environments were also taken where permitted. This added further richness to the field notes, the data analysis and the case understanding that was developed (Figure 3-17).



A = A board in the entrance of Case A's factory, it displays the very latest priority projects (all focused upon delivering incremental innovations to their core product range).

B = The quality manager of Case A demonstrating how the workers in the factory are contributing to incremental process improvements.

C, D and E = Examples of Case C's creative environment at their Future Centre in Sweden.

Figure 3-17: Examples of the innovation environments in two of the industrial collaborators

☐ Overlapping data collection and analysis

Authors such as Glaser and Strauss (1967), Robson (1993) and Silverman (2000) state that whilst in the field it is good practice to overlap data collection with data analysis (the employment of after the fact data analysis techniques will be discussed in more depth later in this chapter). As stated above the use of the split-page field note technique facilitates the overlap of data collection and analysis. This overlap is advantageous as it gives the researcher a head start and increases the flexibility of data collection (Eisenhardt, 1989). The author also used the collaborative academic-industrial approach to take further advantage of overlapping data analysis with data collection in a group context; a notion propagated by Yin (1994) and Glaser and Strauss (1967). The cross-functional, multi-level and multi-organisational workshops enabled three important activities:

- Collection of in-depth qualitative data for case study building.
- Individual researcher data analysis, enabling new insights and knowledge to be generated.

- Academic-industrial joint coding and analysis of the data.

A typical workshop would involve each of the collaborators presenting to the group a partial or holistic view of their innovation process. The academic-practitioner audience would then ask questions of the presenter(s) in order to better understand their organisation's innovation efforts. This process naturally generated data that could be instantly categorised into the four units of analysis that Partington (1998) states are essential for building management theory:

a) the external organisational context, b) the internal organisational context,

c) individual and managerial cognition and d) management actions taken.

☐ • Maintaining flexibility: Controlled opportunism

Overlapping data collection and analysis not only allowed the author to gain a richer understanding of each case but increased the investigation's flexibility, allowing new or interesting avenues to be pursued as they arose. Such "flexibility is not a licence to be unsystematic. Rather this flexibility is controlled opportunism in which researchers take advantage of the uniqueness of a specific case and the emergence of new themes to improve resultant theory" (Eisenhardt, 1989:539). The utilisation of break-out groups during the workshops became a useful tool for probing emergent themes (Figure 3-18).

Figure 3-18: A breakout group probing an emergent theme –
"does Case A need a 'nose-like-process' to 'smell-out' innovative ideas?"

Although analysing data is the heart of building theory from case studies, it is both the most difficult and least codified part of the process (Miles and Huberman, 1994). There are almost as many data analysis methods as there are researchers (Eisenhardt, 1989); however, Yin (1994) and Eisenhardt (1989) show that these can be categorised into two overarching data analysis approaches - *within case analysis* and *searching for cross case patterns*. How these approaches were utilised, how extant literature was used, and how validity was tested will be presented in the following sections. The detailed results and outputs are presented in the next chapter.

3.4.5 Entering the field: Expert interviews

Objectives

- *To conduct interviews with 3 innovation experts, one from industry and two from academia.*
- *To maintain extensive field notes, ensure synchronous data collection and analysis and deliver controlled opportunism throughout the process.*

The five tentative constructs on disruptive innovation (formed following a review of the literature and initial conversations with industrialists) were used to shape questions for semi structured interviews (Figure 3-19). Three innovation experts were interviewed in the first wave of research activities:

- The European head of human factors from the world's leading product design consultancy.
- Two British academics from the field of innovation and new product development.

In order to capture the full richness of the discussion (Robson, 1993), each interview was recorded and transcribed. Notes were also taken using the *split-page field note technique*, as previously described. The combination of these techniques allowed for on the spot analysis and enabled the author to maintaining flexibility, or controlled opportunism, throughout the process.

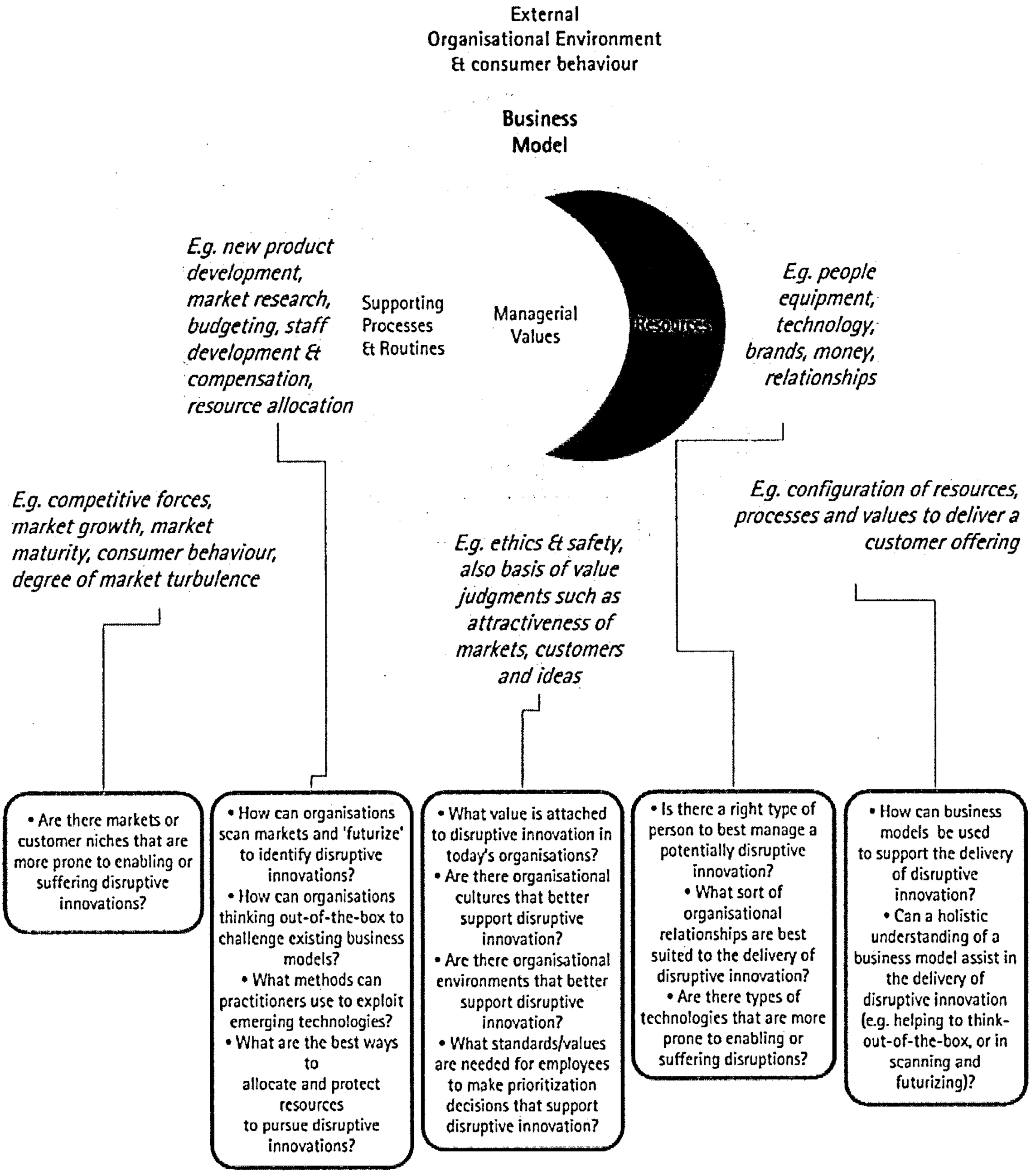


Figure 3-19: Questions used to guide the researcher in semi-structured interviews

3.4.6 Analysing the data – within case analysis

Objectives

- *To become intimately familiar with each case as a stand alone entity.*
- *To allow the unique patterns of each case to emerge before the push to generate theory.*

Robson (1993) notes that researchers attempting to become familiar with their cases commonly face the temptation to jump to conclusions from limited data because they:

- are over-influenced by specific data vividness,
- ignore basic statistical properties,
- are over-influenced by elite respondents, or
- inadvertently drop disconfirming data.

Yin (1994) states that to avoid this temptation the researcher should create detailed case study write-ups for each site. These are simply pure descriptions yet often prove central to the generation of insights (Eisenhardt, 1989). Thus, the premise of within case analysis is for the researcher to become intimately familiar with each case as a stand alone entity, this "allows the unique patterns of each case to emerge before investigators push to generalise" (Eisenhardt, 1989:540). From the outset of the data collection, an open coding approach (Strauss and Corbin, 1997) enabled the author to categorise field notes, transcripts and other material into patterns, themes, concepts and categories. In accordance with Strauss and Corbin (1997) the coding system was refined as the data collection proceeded; the use of a database facilitated this process (see appendix 4). Thus, the early coding system facilitated the within-case analyses; it was simple and it allowed for a uniform capture of information (Table 3-4) and was essential in enabling the author to become intimately familiar with each case before seeking similarities and differences.

Category Title	Category options
Unit of Analysis	- Level 1: Management Action. - Level 2: Individual Managerial Cognition. - Level 3: Internal Organisational Context. - Level 4: External Organisational Context.
Basic Categorisation of innovation pipeline	- Beginning - e.g. idea generation and capture. - Middle – e.g. new product/service development. - End – e.g. exploitation. - Process Support.
Inhibitor / Enablers	- Inhibitor. - Enabler. - General Comment.

Table 3-5: The early phase data coding system.

3.4.7 Analysing the data: Searching for cross case patterns

Objectives

- *To look for similarities and differences, both within and across the cases, using dimensions drawn from the literature on disruptive innovation.*
- *To use the perspectives of multiple practitioners to analyse data and search for patterns across all four cases.*
- *To break simplistic frames and generate a deeper understanding, by juxtaposing cases with apparently similar elements and forcing a search for differences in order to develop initial framework or theory.*

Social scientists can use a vast range of qualitative data analysis techniques when searching for cross case patterns (Table 3-5).

Case Study Data Analysis Techniques Yin (1994)	Qualitative Data Analysis Techniques Miles and Huberman (1994)
• Pattern-matching • Explanation-building • Time-series • Program-logic.	• Putting data into different arrays. • A matrix of categories. • Data displays (flowcharts). • Tabulating the frequency of different events. • Examining the complexity of such tabulations. • Categorising information into chronological order.

Table 3-6: Examples of data analysis techniques available to qualitative research

After careful consideration, it was decided to employ a number of data analysis approaches in order to maximise the benefits of the collaborative Mode 2 approach. This strategy was inspired by the Grounded Theory methods developed by Glaser and Strauss (1967). It was established to ensure new knowledge emerging from the research activities would bare a close fit with the data and the real world.

Thus, to analyse the data, full advantage was taken of the techniques known as 'multiple perspectives' (Yin, 1994) and 'paired cases' (Gibbons et al, 1994). Workshops were used to bring together participants from all four cases and were focused upon both extracting and analysing data. It is recognised that findings and patterns are more reliable, stronger and more grounded in real life contexts when they are corroborated across multiple participants (Gibbons et al, 1994; Yin, 1994; Silverman, 2000). The multi-national, multi-functional and multi-level approach employed by this research fully exploited the unique insights possible from different perspectives. Furthermore, the technique of 'paired cases' (Gibbons et al, 1994) enabled industrialists from the case studies and the researcher together to consider and compare each of the case organisations and the interview data. Investigating the subtle similarities and differences between the cases and the interview data facilitated the emergence of a more appropriate coding system and improved constructs for enabling disruptive innovation (constructs with closer fit and more relevance to the experiences of the industrialists). This generated the first revised list of constructs for enabling disruptive innovation (see Chapter 4).

An important part of pushing understanding yet further, was the process of juxtaposing apparently similar elements of the cases and interview data and the forcing of a search for differences. Furthermore, a broad range of conflicting and supporting literature was enfolded into the conversations and discussion (in accordance with Robson (1994) and Eisenhardt (1986)). These activities broke simplistic frames and generated a deeper understanding. The revised list of constructs were combined, restructured and new unexpected concepts emerged to create a fully modified conceptual framework of interacting dimensions for enabling disruptive innovation. As each emergent construct evolved a base of evidence was built; this enabled further refinement and sharpening of the dimensions. These results are presented in Chapter 4.

The benefits of employing these approaches to data analysis are (Eisenhardt, 1989; Silverman, 1999; Yin, 1994):

- They force the researcher to move beyond initial impressions by using diverse lenses.

- They increase the likelihood of accurate and reliable theory - theory with a close fit to the data.
- They simultaneously increase the probability that novel findings in the data will be captured.

The final step to ensuring the data had been rigorously analysed was a deep analysis and coding exercise. This involved procedures for connecting categories developed in the group workshops using a process known as axial coding (Strauss and Corbin, 1997). This is described in the next section.

3.4.8 Building a conceptual framework

Objectives
- *To solidify the emerging frame and tentative relationships into a testable and verifiable conceptual framework using consolidated bases of evidence.*

The emerging frame and tentative relationships that arise from such within and across case analysis can be solidified into a conceptual framework and eventually a theory by completing the following tasks (Eisenhardt, 1989; Partington, 1998):

- Systematically comparing the emergent frame of dimensions with the evidence from each case and each interviewee.
- Assessing the closeness of the fit with the data.
- Sharpening the constructs through refining, defining and consolidating a base of evidence for each dimension.

Using a version of a process known as 'axial coding' (Strauss and Corbin, 1997), the base of evidence underpinning each construct of the newly established conceptual framework was systematically and rigorously analysed. The selection and relation process helped to uncover the top three inhibitors and enablers of each construct. These were selected by considering the frequencies with which they were mentioned and the levels of importance bestowed upon them by members of the research group. This generated a grounded, realistic conceptual framework that is not burdened by complexity. Throughout the axial coding process a broad range of conflicting and supporting literature was cross-referenced (in accordance with Robson (1994) and Eisenhardt (1986)); this enabled the author to further strengthen, challenge, reconfigure and enhance the emergent framework. The completed framework of enablers and inhibitors was discussed with the collaborating industrials, who in turn agreed that it represented the true challenge of fostering

disruptive innovation. Further data was collected during this discussion, this helped to strengthen and enhance the framework yet further.

3.4.9 Enfolding the Literature

Objectives

- *To strengthen and enhance or reconfigure and challenge the emerging framework by assessing it with a broad range of conflicting and supporting literature.*

An essential feature of theory building is the comparison of the emergent concepts or theory with the extant literature. According to Robson (2000) and Eisenhardt (1986) the key is assessing a broad range of conflicting and supporting literature in order to reconfigure and challenge or to strengthen and enhance the emerging framework.

Enfolding the literature proved to be essential to the collaborative methodology employed by the current investigation. In return for the collaboration of the industrialists the author was requested to iterate between presenting findings from academic publications and gathering and collecting data. Both supporting and contrary findings from academic research were presented and assessed with the findings as they emerged. It is believed that this has facilitated a more rigorous collaborative approach to building and improving the conceptual framework.

3.4.10 Reaching Closure of Wave I

Objectives

- *To ensure enough case data has been collected, ceasing the iteration between academic theory and practitioner data at an appropriate time.*
- *To create feedback for instruments and protocols for next wave of activities.*

Tranfield (1998) highlights the perception that collaborative research can be viewed as less rigorous due to the industrial partners' demands for practical conclusions. From the outset, the author was conscious of this issue, the potential for information processing biases and the temptation to leap to premature or false conclusions. Therefore, this research maintained the tension between investigating and assimilating for as long as possible by adopting a rigorous yet practical data collection and analysis strategy. To maintain credibility and industrial support, it was important to preserve transparency of data collection through to conclusions (although Figure 3-15 previously illustrated three linear waves of data collection and analysis, in reality the stages were much more cyclical, involving constant feedback between all participants of the research group).

A researcher can ensure academic rigour by completing full investigations, deep impartial analyses of the resultant data and finally reaching closure at an appropriate juncture. To do this, Eisenhardt (1986) suggests that social scientists, who use inductive case study approaches, have two ways of

ensuring that they reach effective closure of their investigations. Essentially, the iterations stop if a saturation point is met:

- It is time to stop collecting data when the incremental improvements to the theory or framework are minimal.
- It is time to stop iterating between extant theory and the data when the incremental improvements to the theory or framework are minimal.

Finally, a 'lessons learnt' graphical facilitation exercise was conducted to close the final workshop of Wave I of the research. This captured all the positive and negative experiences of the preceding 15 months and generated a rich source of feedback to begin the second wave of research activity.

3.5 Wave II: Understanding of the priority dimensions of the conceptual framework.

The second wave of this research was an exploration to discover the four most critical areas of management action and management cognition to which the delivery of potentially disruptive innovations are most dependent. The methodology presented in the remainder of this section illustrates how this was achieved and how in the closing stages analysis led to the identification of the primary inhibitor of management practitioners who pursue disruptive innovation. This discovery led to the emergence of a research hypothesis for the third wave of the investigation.

3.5.1 Crafting instruments and protocols: Building collaborative working practice to identify focus areas from the conceptual framework

Objectives

- *To construct protocols and tools that will facilitate the identification of focus areas within the emergent framework of disruptive innovation.*
- *To maintain the commitment to the collaborative research and the ethos of openness and trust.*

When attempting to satisfy the objective of crafting instruments and protocols, to help deliver the second wave of the research, significant consideration was paid to the lessons learnt from the first wave of research activities. The high levels of trust and openness that had been achieved were highlighted as a critical success factor. Furthermore the graphical facilitation approach was seen as pivotal in delivering construct equivalence. The need for the collection of rich data in a

collaborative setting was again apparent at the onset of the second wave of research activity; this inspired the development of another cyclical data collection and inductive data analysis process (Figure 3-20).

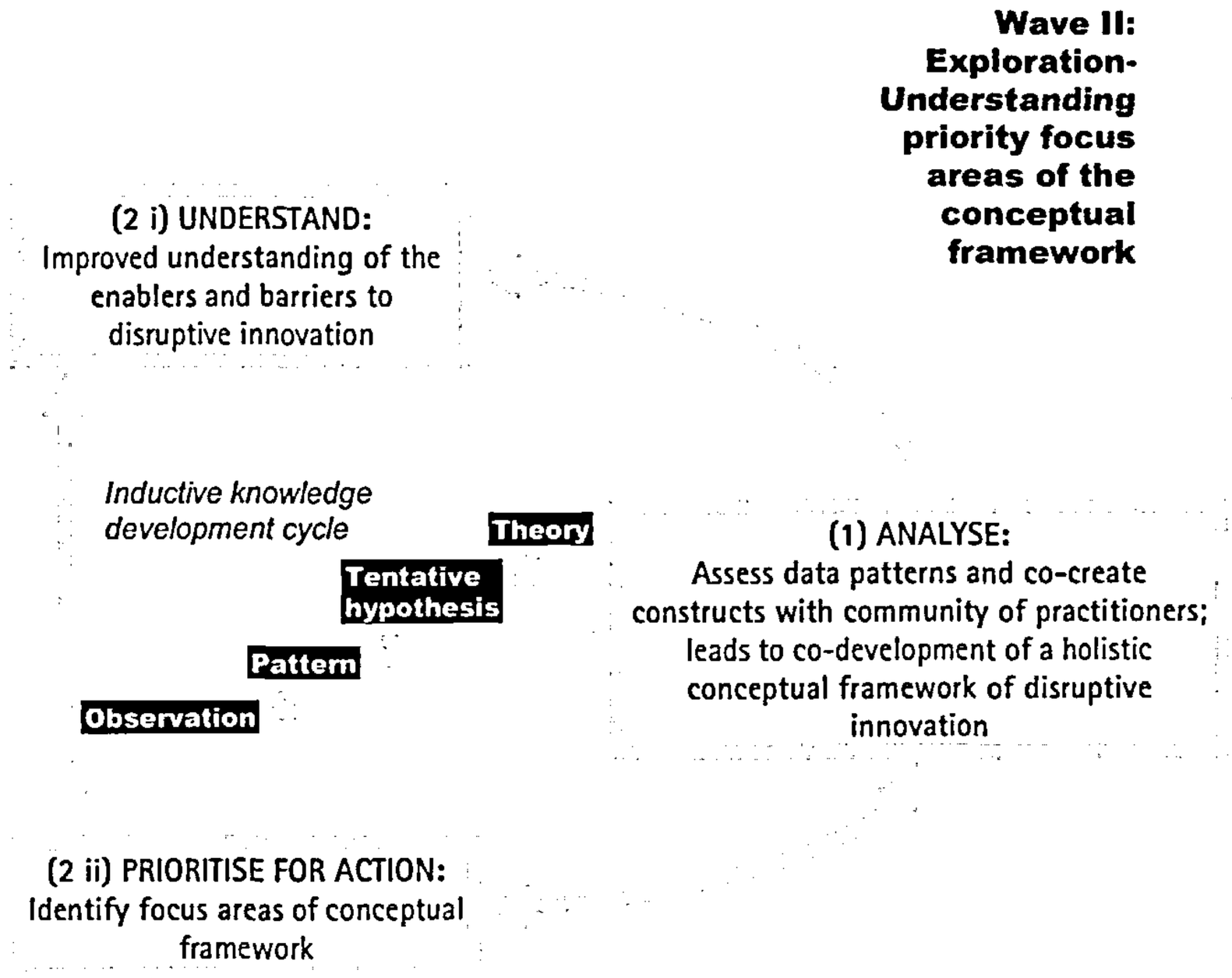


Figure 3-20: The researcher driven, collaborative, inductive-learning approach used in the second wave of the research.

This new re cycle was designed to use the improved understanding of disruptive innovation to identify focus areas for management action, which can in turn be used to improve the grounding of the conceptual framework. The use of large-scale illustrations of the conceptual framework, to facilitate further data collection in the first wave of the research, had been highlighted as a success. Thus, instead of inventing new tools to facilitate the identification of priority areas within the conceptual framework of disruptive innovation, it was decided to use the framework itself as an instrument in the research design. This was important as it further extended the work of the collaborative Mode 2 approach and benefited from high-levels of construct equivalence. Thus, the conceptual framework that emerged from the first wave of the research was used in three ways:

- As the basis of a graphical facilitation workshop designed to analyse each case and highlight weaknesses, thus identifying the priority areas.

- As a method of assessing and recoding the details of existing management tools, which are available to practitioners seeking to deliver radical innovation and beyond.
- As a method of recoding how the collaborating practitioners envisage tackling their barriers to disruptive innovation.

3.5.2 Entering the field: Wave II

Objectives

- *To conduct multi-level, multi-functional data collection workshops within single case and multi-organisational settings, in order to elicit focus areas from the framework and to discover how practitioners envisage overcoming the major challenges of disruptive innovation.*
- *To present to the collaborating industrialists the results of an investigation into 'innovation enabling tools', in order to provoke discussion, debate and further insights into the focus areas.*
- *To conduct interviews with 3 innovation experts, two from industry and one from academia.*
- *To maintain extensive field notes, ensure synchronous data collection and data analysis and flexibility to deliver controlled opportunism throughout the process.*

DATA COLLECTION TECHNIQUE	OBJECTIVES
☐ 4 x semi-structured interviews; one interview with a member of the senior management team in each of the four cases. ☐ Email discussions with the research group. ☐ 1 x three-day multi-organisational workshop with all 4 cases (plus three additional participants from the outlying organisations illustrated earlier in Figure 3-10). There were 15 participants in total.	• To build agreement of the research process and initial understanding of the major case specific barriers to disruptive innovation. Days one and two : • To identify priority focus areas of the conceptual framework for each case. • To enhance understanding of each case's focus areas by conducting cross case comparisons. Day three: • To select one focus area as a management priority and to consider acceptable and feasible management solutions • To mitigate against the temptations of "going native" (where researchers become so close to their subjects that they lose their objectivity) by collecting data from outside the research group to corroborate or undermine the case study output.
☐ Interviews with 3 innovation experts, 2 from industry and 1 from academia. ☐ 2 x semi-structured telephone interviews with the manufacturing cases.	• To conduct in-depth follow-up analysis.

Table 3-7: The method employed in Wave 2 to find the priority focus areas of the conceptual framework

Table 3-6 summarises the data collection and data analysis strategy employed in this second wave of research. Data were gathered from the practitioners of all four cases in graphically facilitated workshops and interviews. In accordance with the approaches recommended by Robson (1993); Yin (1994), Silverman (1999) and Eisenhardt (1989) the current investigation once again has placed emphasis on the use of field notes, overlapping data collection and analysis and the maintenance of flexibility throughout the process in order to advantage from controlled opportunism. Furthermore advantage was taken, once again, of the highly collaborative approach, using the multiple perspectives of the group for synchronous data collection and analysis – the dominant units of analysis under consideration were management cognition and management action.

The dimensions of the conceptual framework were also used to facilitate semi-structured interviews with individuals outside the collaborative research group. Three innovation experts were interviewed during the second wave of research activities:

- One senior innovation consultant from Europe's largest mobile telecommunications organisation.
- The director of innovation of a leading multinational advertising and media company.
- A professor and author on regional innovation networks.

3.5.3 Analysing the data:

Within case analysis and searching for cross case patterns: Wave II

Objectives

- *To become intimately familiar with the focus areas of the conceptual framework of disruptive innovation as identified by each case.*
- *To use the multiple perspectives, dimensions and case pairing to generate a deeper understanding, in order to identify one focus area upon which the participants from all four cases are keen to prioritise in the final wave of the research.*

☐ Within-case analysis:

Semi-structured interviews were conducted with a member of the senior management team from each of the four cases; these focused upon identifying and understanding key barriers to the pursuit of disruptive innovation. The findings were analysed on a within-case basis, codified and mapped onto large-scale graphical illustrations of the emergent conceptual framework.

The large-scale graphical illustrations were then used to initiate a three-day multi-organisational, multi-level, multi-functional data collection workshop. Practitioners were split into subgroups in accordance with their organisational affiliation (the three additional participants from the outlying organisations were observers during this early process) and each group was given a copy of a graphical illustration of the conceptual framework specific to their case. Common to all four graphical illustrations were the depicted constructs of the framework, illustrated with listings of their major characteristics; specific to each case were samples of data from the interviews described above. The large-scale templates were then used to provoke within case dialogue and debate on the major inhibitors and enablers of disruptive innovation. The participants captured their discussions by recording key points onto post-it notes and transferring them to the relevant areas of the conceptual framework. In doing so, four rich pictures emerged from the early discussion, one for each case. The practitioners were asked to identify focus areas to which they believed the delivery of potentially disruptive innovations were most dependent. The author walked from group to group pushing for ideas, and challenging the industrialists not to focus upon symptoms but to discover root causes. Ensuring the practitioners constantly asked "why?", when they began to descend upon a potential focus area, assisted in delivering a deeper analysis. By continuously moving through the cycle of *analyse-understand-prioritise-analyse*, the four groups eventually reduced their lists of focus areas down to four case specific priority focus areas. This process delivered a thorough within-case analysis and advantaged from the multiple perspectives of practitioners - each subgroup being made up of at least two participants.

☐ **Searching for cross case patterns:**

The groups presented and compared their rich pictures of focus areas. In doing so, it was possible to identify cross case similarities and differences. As was seen in the first wave of the research the juxtaposition of apparently similar elements of the cases and the forcing of a search for differences became important part of this process. Chapter 5 illustrates how simplistic assumptions were broken, as a deeper, commonly shared understanding emerged regarding primary root-cause-barriers to the pursuit of potentially disruptive innovations. The outcome was the identification of one focus area that participants from all four cases were keen to prioritise as the focal point for the final wave of the research.

3.5.4 Shaping the priority focus areas of the conceptual framework and enfolding the literature

Objectives

- *To sharpen, refine and define the emergent focus areas by using case data and survey data to build a base of evidence for each dimension.*
- *To strengthen and enhance the emergent focus areas with a broad range of conflicting and supporting literature, paying particular attention to the prioritised focus area.*

☐ Shaping the priority focus areas:

Methods for refining concepts that emerge from data were presented earlier in this chapter. The nature of the methodology meant that much of this activity, such as building a bases evidence etc., was carried out during the data collection and analysis phase.

As Chapter 5 shows, an unexpected outcome of the cross case analysis process was the emergence of focus areas, represented as significant barriers to disruptive innovation, which were common to all four cases. The results chapter shows the practitioners did not initially use the same explanations or descriptions for their focus areas. However, cross-case examination and search for cross-case patterns revealed that the semantics and root causes underpinning the case specific focus areas were the same in each organisation. Furthermore, the enfolding of data from the expert interviews only led to the consolidation and enhancement of these four focus areas. This suggests that the outcomes (presented in the proceeding chapter) had a strong fit with the data and real life experiences.

☐ Enfolding the literature:

As stated previously, in return for the collaboration of the industrialists the author was requested to iterate between presenting findings from academic publications and gathering and collecting data. Both supporting and seemingly contrary findings from academic research had been presented, these were enfolded to strengthen and enhance the emergent focus areas, with particular attention paid to the prioritised construct.

3.5.5 Reaching closure of Wave II

Objectives

- *To stop data collection at an appropriate time.*
- *To create a specific research focus for the third wave of the investigation based upon the prioritised focus area.*

Eisenhardt's (1989) guidelines on reaching closure when conducting theory building research were employed in the same fashion as the first wave of the research. Thus, iterative searches between data and literature were completed to the point of saturation for each of the four emergent focus areas.

The needs of the industrial collaborators added one final task to the closure of this second wave of research. Plans had to be generated on how to establish the industrial utility of the new insights and knowledge. Thus, the author had the opportunity to further probe the prioritised focus area and to generate a critical academic and industrial contribution.

Although the author was interested in developing an holistic model regarding the pursuit of disruptive innovation, Antaki (1988) notes that often theories and models cannot be tested directly or in full. Instead, researchers derive corollaries from theories (e.g. if theory X is sound, we would expect to find Y - here Y is the corollary) and it is then possible formulate propositions or specifications about that corollary (Gibbons et al., 1994). Concordantly, it was decided that corollaries and specifications could be derived from some of the key findings from the data and extant theory regarding the prioritised focus area. French and Bell (1990) illustrate that such corollaries and specifications can be reconstructed and summarised to form the specifications for management interventions. "[I]nterventions are sets of structured activities in which selected organizational units (target groups or individuals) engage in a task or a sequence of tasks where the task goals are related directly or indirectly to organizational improvement. Interventions ... make things happen" (French and Bell, 1990:113). As such, it was decided that if a management intervention, which embodies the findings of this investigation, could be implemented with positive affect, then the knowledge generated by this investigation could be said to offer significant industrial utility. Furthermore, if a researcher is involved in the implementation of a management intervention, using knowledge and insights gained from their investigations, then they are permitted a unique opportunity to both collect new data and to witness first hand the relevance of his or her research. Accordingly, it was decided that a management intervention would be developed utilising the knowledge gathered upon the prioritised focus area. The aim was to contribute an industrially relevant management tool and to create an academic contribution to knowledge regarding the prioritised focus area, via an improved understanding.

3.6 Wave III: Probing and testing the prioritised focus area

The third wave of this research was designed to be more descriptive in nature. The research activities were designed to provide a deeper understanding of the prioritised focus area and to assist in establishing industrial utility of the findings. Thus, the final wave of this investigation aims to reveal implications for the wider conceptual framework, developed in the first wave of research activities, along with a series of management implications. A full description of the collaborative Mode 2 methodology employed in the final wave of this research is presented in the remainder of this section.

3.6.1 Selecting cases for Wave III

Objectives

- *To develop case and interviewee selection criteria.*
- *To select appropriate cases to be involved in the final stage of the collaborative research.*
- *To identify interviewees to be involves in survey strategy.*

☐ Selecting cases for the focused inquiry:

Innovation literature is extensively focused upon product and process innovation, leaving a significantly smaller percentage of publications that report upon service innovation (Wheelwright and Clark, 1992). This means that researchers have a much richer base of evidence to draw upon when conducting investigations into product orientated organisations. For this reason the focused investigation into the funding barrier to disruptive innovation concentrated upon the activities of the two disparate manufacturing cases (cases A and B) already under consideration.

☐ Selecting external candidates for interviews during the focused inquiry:

Once again, to mitigate against the temptations of "going native" (Van Maanen, 1988) – where researchers become so close to their subjects that they lose their objectivity – interviews with innovation experts were conducted. Four industrial candidates were selected in accordance with the interviewee selection criteria stated in section 3.5.2 of this chapter:

- The founder and director of one of the UK's leading small management consultancies, which focuses upon delivering 'breakthrough business innovation'.
- The former head of technology commercialisation of a world leading national organisation based in the aeronautics and space industry.
- The former Director of Technology of a leading national manufacturer from the computer printing industry.
- The Chief Executive Officer of a leading national semiconductor manufacturer.

3.6.2 Crafting instruments and protocols: Building collaborative working practice to build and test theory generated about the chosen priority area of conceptual framework

Objectives

- *To develop a schedule of activity, whereby iterative feedback between the author and industrialists results in the construction of an intervention to test the research hypothesis.*
- *To develop a schedule of activity to implement the intervention and to employ data collection tools, such as questionnaires, structured interviews and independent observations.*
- *To consider the authors impact as a participant-observer and to mitigate for negative affects.*
- *To agree mechanisms whereby a contribution to knowledge can be asserted and a contribution to industrial practice can be demonstrated.*

The instruments and protocols needed to deliver the third wave of this research were developed in partnership with the cases under consideration. The group focused upon the development and implementation of an intervention that could either confirm or disconfirm the hypothesis. Akin to the previous activities, a cyclical approach to data collection and data analysis was developed (Figure 3-21). Unlike the previous cycles of research activity, this cycle was designed to be completed only twice and also included elements of quantitative data collection and deductive data analysis.

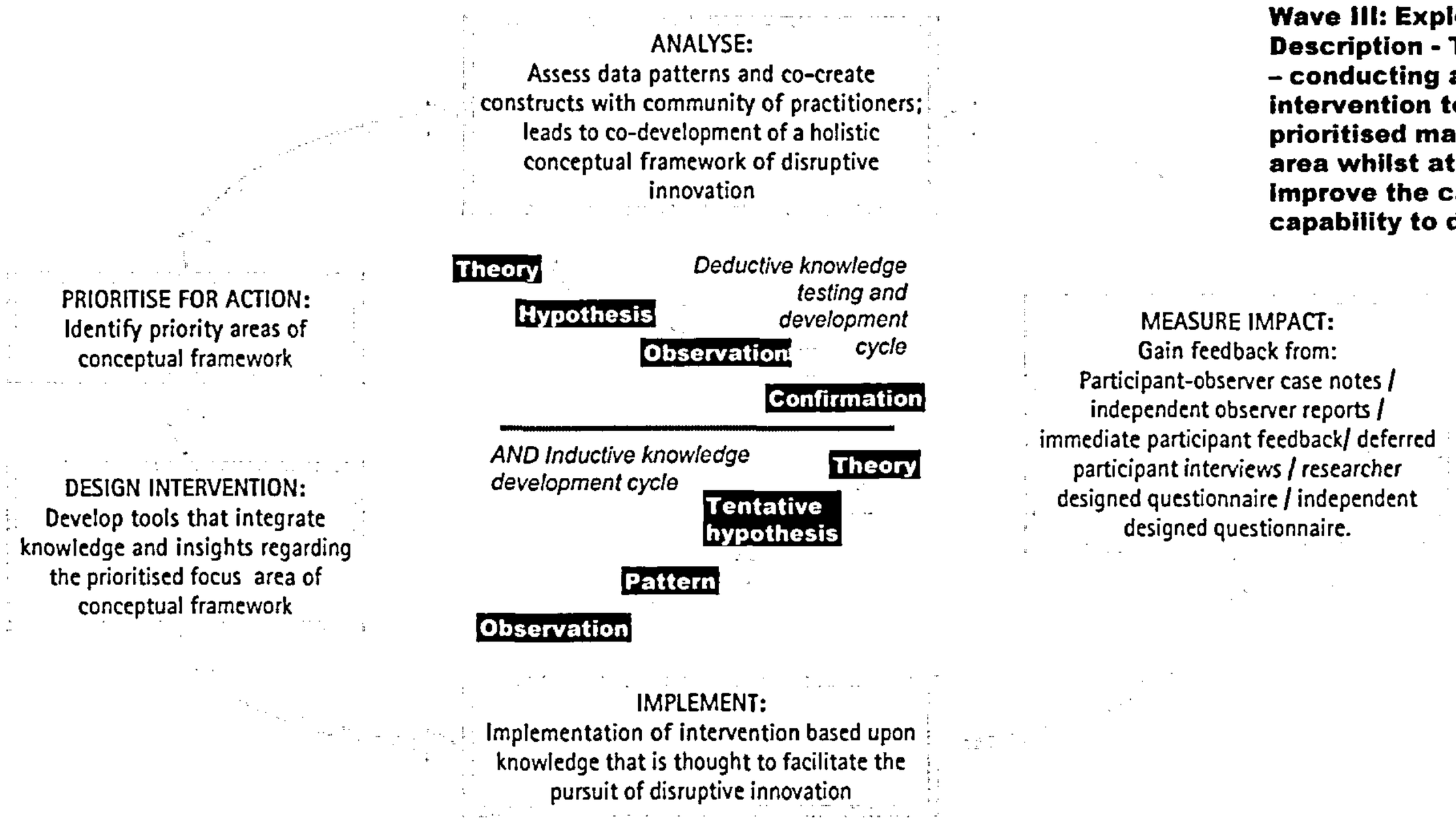


Figure 3-21: The researcher driven, collaborative, inductive-deductive learning approach used in the third wave of the research.

A plan was agreed, which comprised of similar instruments and protocols developed and utilised in the previous two waves of research activities:

- A series of workshops, interviews and telephone conferences were to be conducted, contributing towards the development of a management intervention.
- The intervention was to be designed by the author in a process of iteration between academic theory and practical recommendations from the senior practitioners involved in the research thus far.
- It was agreed that the intervention would take the form of a workshop that could be administered by the author to the senior management teams of both cases A and B.
- The first complete version of the intervention was to be implemented within Case A - the small manufacturer.
- Data from observations made during the first intervention were to be assessed along with post-intervention interviews and questionnaires; this would contribute to a deeper understanding of Case A and deliver an impact assessment of the management intervention.

- Analyses from the first implementation were to be used to make modifications to the design of the intervention, and the modified intervention was then to be implemented in Case B – the large manufacturer.
- It was agreed that observations and data from this second larger implementation site would be collected and analysed using three approaches:

a) The author would use coding techniques, such as those proposed by Strauss and Corbin (1997), to analyse the data from his observations and post-intervention questionnaires and interviews

b) A senior management consultant, independent from the current research and with prior experience of working within Case B, was invited to observe the intervention and asked to assess the impact of the workshop from her observations and post-intervention interviews.

c) It was decided that the two cases should provide their own feedback about their experiences during and after the intervention. Presentations were scheduled to be made by senior managers of both organisations to all the members of the EC co-sponsored project "Disrupt-it" and a European Commission selected review panel.

3.6.3 Entering the field: Wave III

Objectives

- *To conduct two participant-observer intervention workshops in order to probe the prioritised focus area.*
- *To employ multiple forms or data collection tools in order to both collect evidence regarding the prioritised focus area and the effectiveness of the management intervention.*
- *To conduct interviews with four innovation experts from industry in order to mitigate against 'going native'.*
- *To maintain extensive field notes, and to ensure synchronous data collection and data analysis with the flexibility to deliver controlled opportunism throughout the process.*

Once again the dominant units of analysis under consideration when in the field were management cognition and management action. These data were gathered from the practitioners within both cases via telephone conferences and in graphically facilitated workshops and interviews. Tables 3-7 3-8 and 3-9 summarise the data collection strategy that was employed in the field. Throughout

the three phases of this last wave of research, the existence of open communication and trust, between the author and the industrial parties, became the key facilitator of a deeper case study investigation into the prioritised focus area.

PHASE	DATA COLLECTION TECHNIQUE	OBJECTIVES
Phase 1: Building deeper understanding and designing the management intervention	☐ 2 x semi-structured telephone interviews with cases A and B, plus informal email and telephone conversations. ☐ CASE A: 1 x Two-day workshop with senior management team (5 participants), including tour of site. ☐ CASE B: 2 x Telephone conferences with senior managers and engineers (4 participants in total).	• To gather more data regarding the prioritised focus area • To and present initial findings and discuss with practitioners in order to iteratively home in on the roots of problems. • To deliver more detailed understanding of case specific issues regarding the prioritised focus area. • To better understand individual requirements for solution types. • To use these findings to steer the design of the management intervention

Table 3-8: The first phase of the method to deliver a deeper understanding of the prioritised focus area.

During phase 1, the practitioners were asked to consider the prioritised focus area and to recount stories from the past and to explain their prevailing current day situations, they were also presented with and discussed summaries of relevant state of the art academic literature. The aim was to use the insights gained from this data collection in combination with best practice guidance from academic literature in order to steer the design of a management intervention. Inspiration for this approach to designing the intervention was taken from French and Bell (1990) and the notions presented by Amis, Slack and Hinnings (2004) regarding the integration of trust-building and sensitivity when intervening with high-impact elements of an organisation. Consequently, the data collection activities were, in a sense, viewed by the management practitioners as a series of requirements gathering and understanding exercises for the intervention. This was conducted in what was referred to as the 'iterative V' approach (Figure 3-22). Accordingly, this led to the creation of an intervention that was acceptable to the top management teams of both manufacturing cases (Figure 3-23 illustrates the output of one of the latter intervention design meetings in which the first high-level intervention process was designed). The intervention that emerged was based upon a recognised and well developed management tool, modified to

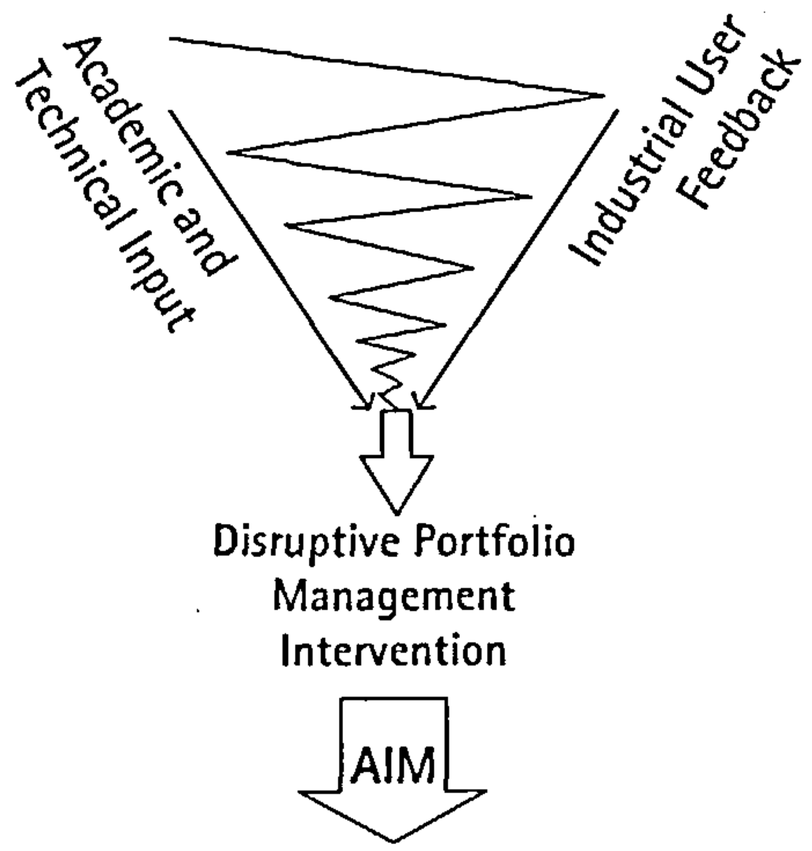


Figure 3-22: The 'iterative V' approach used to design the management intervention.

incorporate a state of the art understanding of disruptive innovation, and which also incorporated the findings from the data collection. The resultant management intervention is briefly described in Chapter 6 and a more thorough description is offered in Appendix 5.

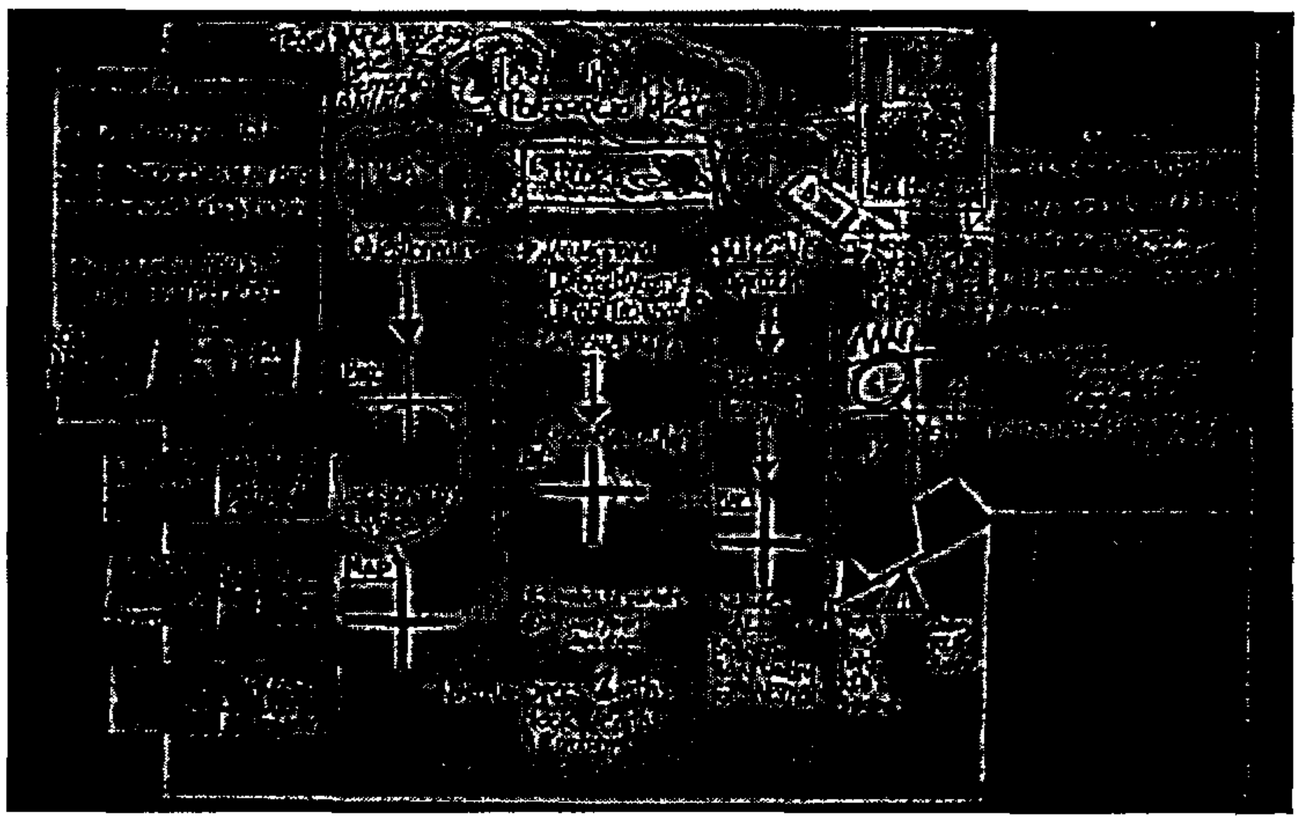


Figure 3-23: The first process design of the management intervention delivered via the 'iterative V' approach

Phase 2: Implementing intervention	☐ CASE A: 1 x Two-day workshop with senior management team (5 participants).	• To conduct a two-day implementation of the management intervention in order to better understand the prioritised focus area.
	☐ CASE B: One-day of in-house innovation project assessments and 1 x one-day workshop with senior management team and senior engineers (16 participants).	• To conduct a two-day implementation of the management intervention in order to better understand the prioritised focus area.

Table 3-9: The second phase of the method to deliver a deeper understanding of the prioritised focus area.

In phase 2 the intervention was first implemented over two days with the senior management team of case A – there were 5 participants in total. Extensive field notes were taken, immediate participant feedback was recorded, significant post-workshop researcher reflection was documented and two post-intervention interviews were completed with the CEO and the Head of Quality. This provided a detailed within-case analysis that revealed numerous insights into the focus area and the management intervention. Moreover, it was planned that feedback would be used to deliver process refinements that would improve the management intervention, especially as it was to be completed next in Case B - a larger more R&D intensive organisation. Once the modifications were made the intervention was administered as a one day workshop with the senior management team and a group of senior engineers from Case B – there were 16 participants in total. During the second implementation extensive data were accumulated using the aforementioned techniques.

Phase 3: Post intervention feedback	☐ Gathering immediate feedback: CASE A: - Group discussion. - 2 x post intervention interviews. - 4 x post intervention questionnaires. CASE B: - Group discussion. - 3 x post intervention interviews. - 4 x post intervention questionnaires. ☐ Gathering feedback after 2 months: CASE A: - 2 x post intervention phone interviews. - 1 x presentation from executive manager. - Multiple email conversations. CASE B: - 2 x post intervention phone interviews. - 1 x presentation from executive manager. - 1 x report from independent management consultant. - Multiple email conversations. ☐ Gathering feedback after 6 months: CASE A: - Multiple email conversations. CASE B: - 2 x post intervention phone interviews. - 1 x presentation from executive manager. - Multiple email conversations.	• To assess the short term impact of the management intervention. • To whether or not the management intervention had industrial utility. • To sharpen and refine the initial conclusions, drawn from the experience of intervening within cases A and B, into a justified contribution to knowledge.

Table 3-10: The final phase of the method to deliver a deeper understanding of the prioritised focus area.

As outlined in Table 3-9, the final phase involved collecting data two months and six months after the intervention. This continued the deeper probing of the prioritised focus area and enabled the industrial utility of the management intervention to be discussed. Throughout this process, the full dimensions of the conceptual framework were used to facilitate semi-structured interviews with the selected innovation experts from outside the collaborative research group.

3.6.4 Analysing the data: Wave III

3.6.4.1 Within case analysis and searching for cross case patterns – Part 1

Objectives

- *To become intimately familiar with each case as a stand alone entity with the use of extensive field notes and feedback from other data collection techniques.*
- *To conduct cross case analysis and search for patterns.*

Time and access restrictions prevented a study of the longitudinal impact of the interventions, nor were multiple interventions possible. This limited the data collection to the information that could be retrieved from the co-development and implementation of a one-off intervention along with immediate feedback and feedback over a six month period. In accordance with Yin's (1993) advice, purely descriptive case study write-ups were constructed for each case study immediately after the interventions. These were developed through a process based upon extensive field notes, participant feedback, post workshop reflection, and initial post intervention feedback. The within-case analysis process was designed to allow the author to become intimately familiar with the issues regarding the prioritised focus area for each intervention site.

Complex statistical analyses are not feasible with such qualitative studies (Yin, 1994; Silverman, 1999). Therefore, a system was designed and agreed with the case study participants, which would allow the author to use the exercise as a data collection tool whilst also assessing the industrial utility of the management intervention. The system was based upon the completion of a checklist process (Table 3-10) influenced by French and Bell's (1990) prescriptions.

Criteria for assessing the industrial utility of the management intervention.	Case A	Case B
a) On completing the intervention, at least 75% of the participants state that they believe they are in a better position to allocate resources to potentially disruptive innovations.		

b) On completing the intervention, the majority of the participants state that the process implemented is one that could fit existing organisational routines and could be integrated into regular business practice.

c) On completing the intervention, the most senior participants state that they believe that the intervention could be used in the future to overcome the funding barrier and establish new resource allocation routines.

d) Two months after the intervention, the most senior participants state that they believe the intervention will deliver short to medium term benefits.

e) Two months after the intervention, the most senior participants show that the intervention has facilitated the establishment of new approaches to resource allocation that support disruptive innovation.

f) Two months after the intervention, the most senior participants state they believe that intervention may have significantly contributed to their ability to tackle the funding barrier to disruptive innovation in the long term.

g) Six months after the intervention, the most senior participants state that they believe the intervention will deliver medium to long-term benefits.

h) Six months after the intervention, the most senior participants show that the intervention has facilitated the establishment of new approaches to resource allocation that support disruptive innovation.

i) Six months after the intervention, the most senior participants state they believe that intervention may have significantly contributed to their ability to tackle the funding barrier to disruptive innovation in the long term.

Table 3-11: Criteria for assessing the industrial utility of the management intervention.

A detailed codification of the data from each within-case analysis followed, using the methods proposed by Strauss and Corbin (1997) and Miles and Huberman (1994). This activity generated cross case patterns, providing a richer analysis of the prioritised focus area under consideration. A number of tentative constructs and managerial implications were developed.

3.6.4.2 Within case analysis and searching for cross case patterns – Part 2: validating the emergent dimensions of the prioritised focus area and enfolding literature.

Objectives

- *To assess and refine the emergent constructs, dimensions and conclusions,*

regarding the prioritised focus area, with supporting and challenging insights.

- *To strengthen and enhance the emergent dimensions of the prioritised focus area with a broad range of conflicting and supporting literature.*

To assess and refine the emergent constructs developed during the initial cross-case analysis and to build more reliable managerial implications, the author employed a five-fold approach (Figure 3-24):

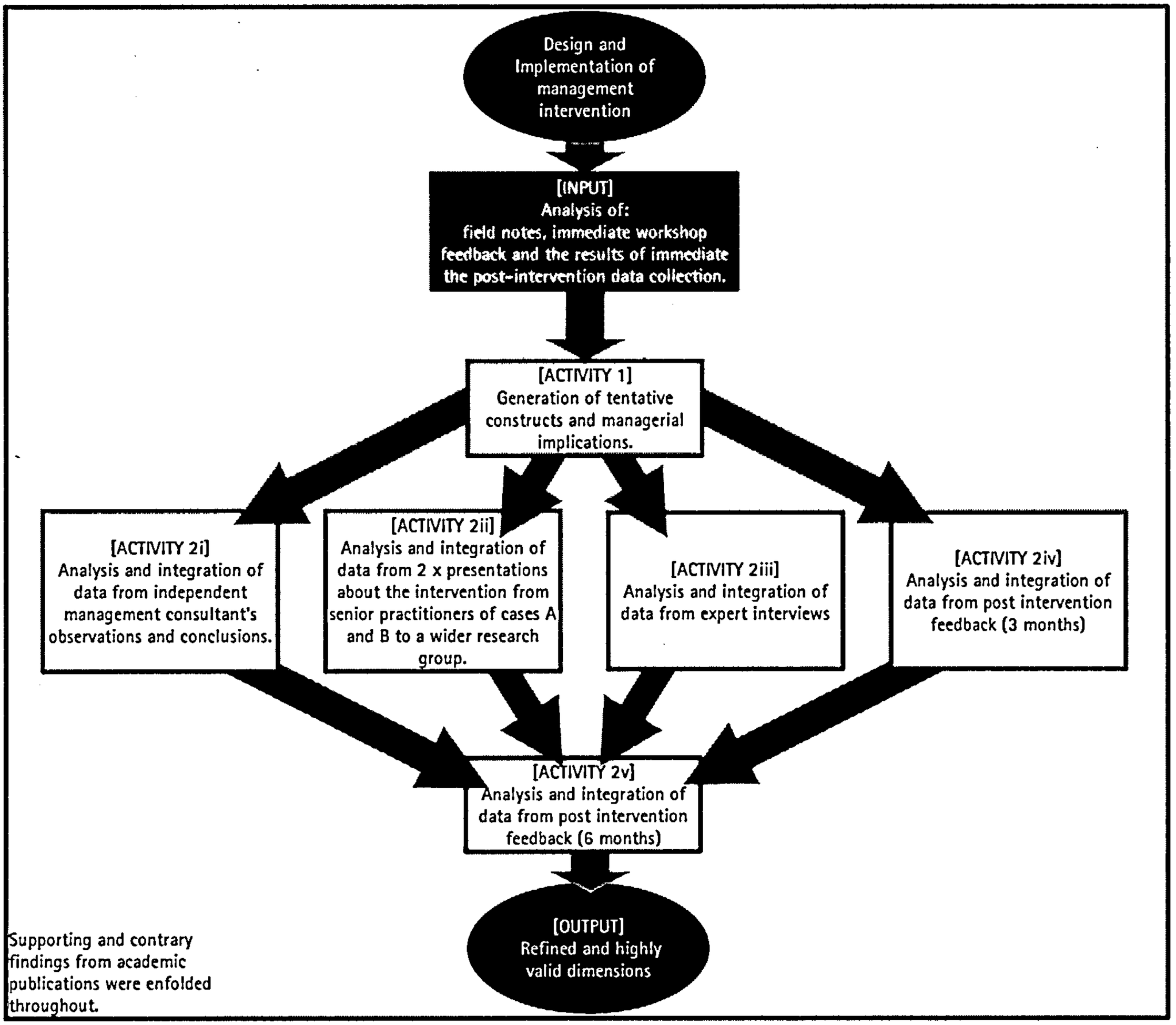


Figure 3-24: Refining the emergent dimensions and delivering deeper understanding of the prioritised focus area.

(1) Data from a report produced by a management consultant who was acting as an independent observer was codified and enfolded into the emergent dimensions.

(2) Two months after the interventions took place, both cases A and B delivered presentations to a wider research group regarding their experiences with the management intervention. These data were enfolded into the emergent dimensions of the prioritised focus area.

(3) Data from the four expert interviews were analysed and enfolded in parallel.

(4) Data from post intervention feedback, gathered after 2 months, were analysed and enfolded.

(5) Data from post intervention feedback, gathered after 6 months, were analysed and enfolded.

Once again an important part of this process was the juxtaposition of apparently similar elements of the cases and the forcing of a search for differences. This process broke simplistic frames, created new categories and generated a deeper understanding of the dimensions. Throughout the whole exercise, academic literature was constantly presented and enfolded into the emergent dimensions, as recommended by Eisenhardt (1989).

3.6.5 Reaching Closure: Wave III

Objectives

- *To ensure enough case data has been collected.*
- *To know when to stop iterating between academic theory and practitioner data.*
- *To develop and employ mechanisms by which the industrial utility of the investigation's findings can be accepted or rejected and an academic contribution to knowledge can be asserted.*
- *To address the strengths and weaknesses of the research design.*

As with the previous stages, iterative searches between data and literature were completed to the point of saturation – where additional information renders little or no further advantages (Eisenhardt, 1989).

Due to time and resource restrictions the longitudinal impact of the intervention within cases A and B could not be assessed, nor could they be implemented again. Therefore, it was not possible to develop complex statistical tests to aid in accepting or rejecting the industrial utility of the investigations findings. Instead, in collaboration and negotiation with the industrialists involved in the research, a checklist was developed to facilitate a valid and justifiable decision regarding the short term impact of the management intervention. This is described in Chapter 6. Moreover, Chapter 7 will discuss the key findings of this final wave of research, in doing so it will map the

conclusions onto the extant literature and will assert a well positioned, clear contribution to knowledge.

In the final multiple case workshop of this research, time was dedicated to generating feedback upon the collaborative mode 2 approach. This was analysed alongside the feedback that was generated in parallel to the research activities from graphically facilitated 'lessons learnt' sessions. These activities enabled a qualitative assessment of the strengths and weaknesses of the research methodology employed in this study.

3.7 A summary of the research methodology

In consideration of the research objectives it was concluded that this investigation would benefit from a close relationship between the researcher and the subject. Moreover, the research strategy had to be semi-structured, allowing for the collection of rich deep data and the emergence of a relationship between theory and the findings. This enabled to the author to deliver a qualitative study, a mode of investigation missing from the field of disruptive innovation.

A truly heterogeneous group of both industrial practitioners and academics were engaged in this investigation, using a trans-disciplinary approach. In total, 127 industrialists took part in this study. The four different case study sites, from four different countries and four different industries, provided a total 17 management practitioners to make up the core members of the collaborative research group. In addition, 103 employees from the four case study organisations participated in one-off or infrequent data collection workshops and questionnaires. The organisational functions that were performed by the participants could be divided into 9 clusters and the organisational roles could be divided into 8 clusters (Table 3-11).

Organisational Function	Organisational Role
o Finance	o CEO
o Marketing	o Director / Divisional Head
o Purchasing	o Senior Manager
o R&D/Design	o Manager
o Manufacturing/Operations	o Senior Consultant
o Sales	o Consultant
o Human resources	o General Employee
o Legal	o Mixed Role
o Cross Functional	

Table 3-12: The organisational functions and roles of the participants involved in this research.

Seven expert industrialists were interviewed in parallel to the research process, along with three expert academics; moreover, seven members of the EC project 'Disrupt-it' were also consulted either once or intermittently throughout the inquiry.

Four units of analysis were considered, the two primary units were management action and management cognition, thus, a focus upon rich qualitative data collection dominates the research agenda.

Three waves of collaborative research activities were designed (Figure 3-25) in order to fulfil the primary research objective established in Chapters 1 and 2:

To explore the nature and experience of management practitioners' pursuit of potentially disruptive innovations in average performing (or non-best-practice) businesses.

The first wave of research was an exploration to better understand the complex and dynamic phenomenon of the pursuit of disruptive innovation; it was designed to tackle the sub-objective 1:

To deliver an holistic understanding of the key facilitators and inhibitors faced by management practitioners wanting to enable potentially disruptive innovations within their non-best-in-class organisations. And to convert this knowledge into an holistic processual and systemic conceptual framework, grounded in both data and theory.

Over a fifteen month period, a series of workshops, interviews and observations were used in an inductive knowledge development cycle. The analyses of the data and the enfolding of literature were extrapolated into a conceptual framework of enablers and inhibitors that management practitioners face in the pursuit of disruptive innovation. These results are presented in Chapter 4.

The second wave of this research was an exploration to uncover focus areas of management action and management cognition to which the delivery of potentially disruptive innovations are highly dependent; this was designed to satisfy the sub-objective 2:

To explore the emergent conceptual framework in order to identify focus areas of management action and management cognition to which the delivery of potentially disruptive innovations are most dependent.

Data were collected over an eight month period using interviews, telephone conferences, email discussions and workshops. The data analysis and the enfolding of literature revealed four focus areas, in the form of barriers that management practitioners, of average performing companies, face in the pursuit of disruptive innovation. Further analysis led to the prioritisation of one of these

focus areas by all four cases and interviewees; this became the focal point for the third wave of the investigation. These results are presented in Chapter 6.

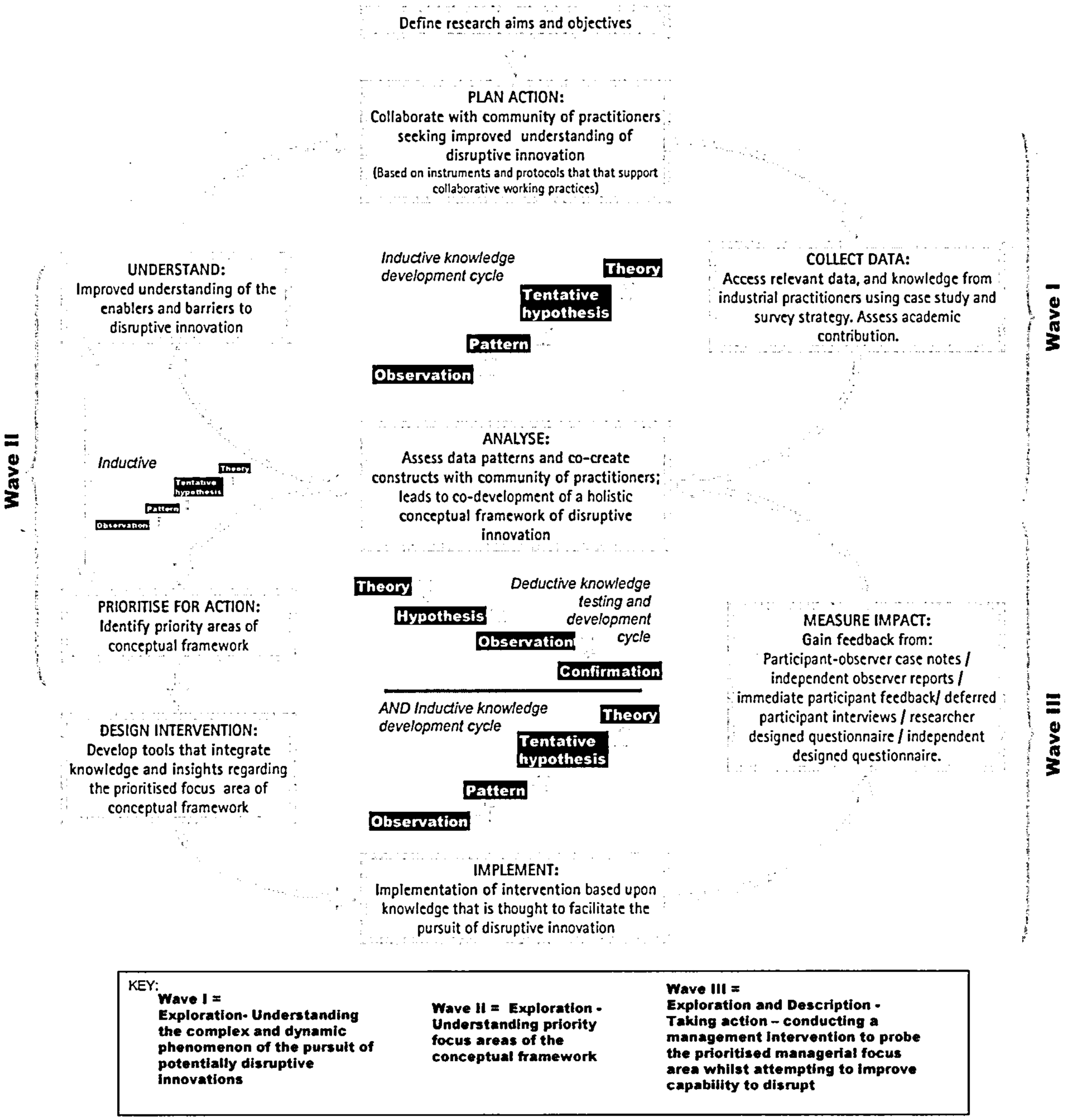


Figure 3-25: The mode 2 research to action cycle –

a researcher driven, collaborative, inductive-deductive learning approach.

The third wave of this research is more descriptive in nature and was designed to address sub-objective 3:

To specify, design and implement a management intervention to probe a priority focus area of management action and cognition. The intervention should be able to build new academic knowledge, whilst simultaneously improving the ability of the participating organisations to pursue potentially disruptive innovations.

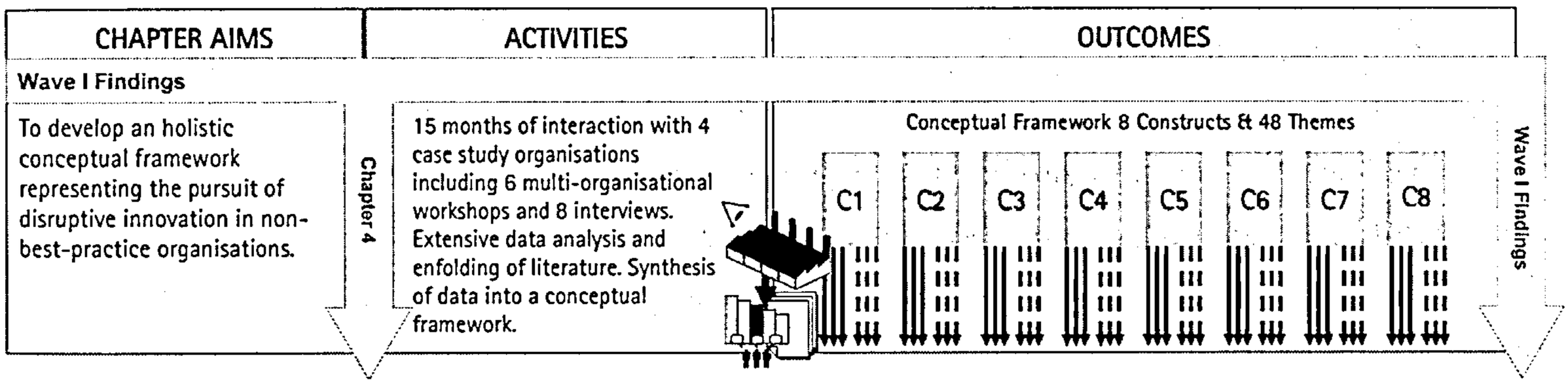
It focuses upon the development and implementation (within cases A and B) of a management intervention that embodied the understanding that had been developed regarding the prioritised focus area. Ten months of research activities were designed to provide a deeper understanding of the prioritised focus area by investigating the complex and dynamic issues faced by management practitioners in this key area of management action and cognition. It was hoped that the analysis of the data would reveal implications for the wider conceptual framework, developed in the first wave of research activities, and a series of management implications along with a well clear contribution to knowledge. The results are presented in Chapter 6 and a full discussion is offered in Chapter 7.

Finally, this chapter was written to offer readers of this thesis a detailed account of the collaborative academic-industrial methodology designed and implemented for this investigation. It is believed that these pages, along with the discussion presented in Chapter 7 and Appendix 8, provide evidence to satisfy the second research objective established at the onset of this research.

To use this investigation as a tool to extend knowledge and practice of collaborative academic-practitioner methodological approaches in the field of innovation research.

4. A Conceptual Framework for Enabling Potentially Disruptive Innovations - The Findings from Wave I of the Investigation

This chapter is primarily dedicated to presenting the conceptual framework for enabling potentially disruptive innovations that emerged from the first wave of this investigation. Preceding this is a brief overview of the objectives and the research method employed in the first wave of the investigation. An overview of the tentative constructs used to guide data collection is also provided. The chapter is concluded with a summary of how the findings relate to the research objectives.



4.1 Introduction

4.1.1 Overview of primary objectives

The primary objectives of the first wave of the research were:

- To identify tentative constructs for the research topic, aiding with data collection.
- To craft instruments and protocols to facilitate a collaborative working practice.
- To deliver an holistic understanding of the issues faced by management practitioners wanting to enable their organisations to deliver potentially disruptive innovations. And to convert this knowledge into a testable and verifiable conceptual framework.

4.1.2 Overview of research methods

The above objectives were achieved within the first 15 months of this research. However, to further ensure reliability and validity, the data collected and analysed in the final 18 months were also integrated in to the emergent conceptual framework. Therefore, the results presented in the following sections draw upon data collected and analysed from three main sources:

- 33 months of regular interaction with cases study organisations A, B, C and D (15 multi-case, multi-level, multi-functional workshops, 6 single case, multi-level, multi-functional workshops, 10 telephone conferences and 12 interviews plus countless email conversations).
- An extensive literature survey.
- Eleven expert interviews (seven experts from industry and three from British academia).

The triangulation (Lewis and Grimes, 1999) of data from these sources facilitated the development of a conceptual framework. The framework identifies the main enablers and inhibitors faced by management practitioners wanting to enable their organisations to deliver potentially disruptive innovations. These were selected by considering the frequencies with which they were mentioned and the levels of importance bestowed upon them by members of the research group.

4.2 The emergence of tentative constructs

Five tentative constructs emerged during the case study selection discussions held in parallel to an extensive survey and categorisation of extant literature: (1) supporting processes or values, (2) resources, (3) management values, (4) business models and (5) the external organisational environment (including consumer behaviour). These were configured as shown in Figure 4-1 below. The constructs were tentative and only used to elicit data from the cases and interviewees. This ensured that knowledge and new constructs would emerge from the research activities and that these new constructs would closely fit the data and, therefore, the real world.

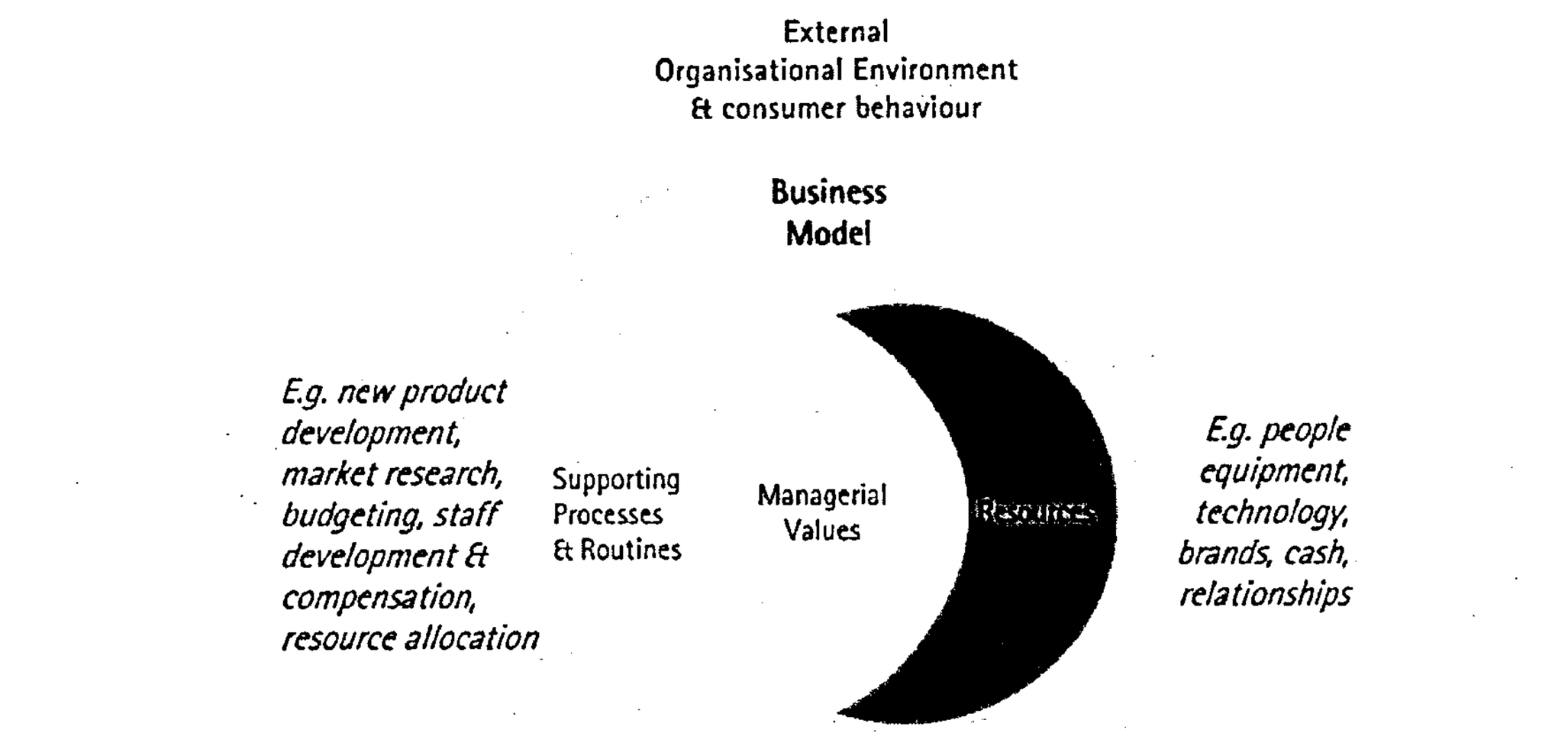


Figure 4-1: Tentative constructs

A list of revised constructs was generated in the early stages of the cross-case analyses, using the techniques of 'multiple perspectives' (Yin, 1994),' paired cases' (Gibbons et al, 1994), the juxtaposition of data and the enfolding of supporting and conflicting literature (Eisenhardt, 1986). The group identified what they felt to be the top ten most important management decision points in the process of disruptive innovation. These could be represented by the linear flow of the innovation process illustrated by Table 4-1.

The remainder of this chapter illustrates the findings from further analysis, in which a deeper understanding emerged that broke the simplistic frame represented in table 4-1. Dimensions were recombined and restructured, and new unexpected concepts surfaced to create a fully modified conceptual framework.

The top ten most important management actions and decisions in the process of disruptive innovation as reported by the case study participants.
(First Round Construct Revision)

1) New Concept Registration/Recognition
2) Decision to Explore (Major Decision Gate 1)
3) Preliminary Investigation
4) Decision to Conduct Detailed Investigation (Major Decision 2)
5) Detailed Investigation of Potentially Disruptive Innovations
6) Potentially Disruptive Innovation Business Case Development
7) Decision to Develop Offering (Major Decision 3)
8) Execute Development Plan
9) Decision to Launch Offering on Market (Gate Decision 4)
10) Marketing for disruptive innovation

Table 4-1: The first list of revised constructs.

4.3 The disruptive innovation conceptual framework

The analysis of fifteen months of workshop sessions, interviews and extensive literature, culminated in the emergence of a conceptual framework for management practitioners who wish to enable their organisations to pursue and deliver potentially disruptive innovations. It was concluded that disruptive innovation can be enabled through the management of seven core components, or modules, and an understanding of how these interact with one another, the external markets and the external environment (Figure 4-2).

For each construct, the three foremost enablers and inhibitors were identified. The enablers and inhibitors are, in effect, mechanisms of management action and management cognition that can be thought of as internal forces or stimuli. Provided the enablers and inhibitors or their effects are attended to, it is believed that a management team will lead its organisation to the purposeful pursuit of disruptive innovation. Without such attention, the enabling mechanisms lie dormant and the inhibiting mechanisms enact processes in the form of a series of events, whether or not explicitly experienced by the organisation's members, which constrain the pursuit of innovation to incrementalism.

Figure 4-2: An overview of the conceptual framework for disruptive innovation.

Organisational Ecology

The capability to manage the organisational ecology (defined by the current research project as the physical infrastructure and the culture of the business) to support both continued business improvement and the pursuit of disruptive innovation.

Innovation Strategy

The capability to align strategic intent (the organisations vision and plans for the future) and strategic action (what comes out of the resource allocation process) in order to deliver the simultaneous pursuit of sustaining and disruptive innovation.

Opportunity Recognition	Opportunity Development	Solution Development	Exploitation	
The capability to simultaneously generate and/or recognise potentially disruptive opportunities and options for sustaining innovation. This involves gathering stimulus and converting it into insights or inventions that lead to the identification of both new potentially disruptive business opportunities and avenues for sustaining innovation.	The capability to select newly identified, high-promise opportunities and to develop a selection of credible business cases that offer the potential for pursuing disruptive and sustaining innovation.	The capability to select a range of sustaining and potentially disruptive business cases and to initiate and support new product/service development projects, in order to deliver pre commercial offerings.	The capability to select and profitably pursue two types of exploitation strategy – 'top-down' strategies, for deliberately driven sustaining innovations, alongside the nurturing of emergent strategies for potentially disruptive innovations.	Potentially Disruptive Innovation

Human Resources

The capability to select, hire and/or nurture managers for new-growth, potentially disruptive businesses, whilst maintaining the selection, hiring and training of managers for sustaining current core activities.

Market and External Environment

The capability to interact with the external environment, with the necessary breadth and depth, in order to support an innovation process that simultaneously pursues sustaining and potentially disruptive innovations.

The enablers and inhibitors are presented in the remainder of this section. Each one is explained, firstly with illustrative evidence, considered to be largely representative of the data set, and secondly, a description is provided which draws upon the wider data set and relevant literature. Note that the participants involved in the research had differing standards of English (both written and spoken). Therefore, a number of the quotes that follow were paraphrased following presentations, conversations and emails, they were either observed or recorded, and were either immediately or subsequently agreed by the appropriate participants.

4.3.1 Opportunity Recognition:

DESCRIPTION: The capability to simultaneously generate and/or recognise potentially disruptive opportunities and options for *sustaining innovation*. This involves gathering stimuli and converting it into insights or inventions that lead to the identification of both new potentially disruptive business opportunities and avenues for sustaining innovation.

ENABLERS:

4.3.1.1 Gather stimuli from the organisation's wider domain.

Evidence:

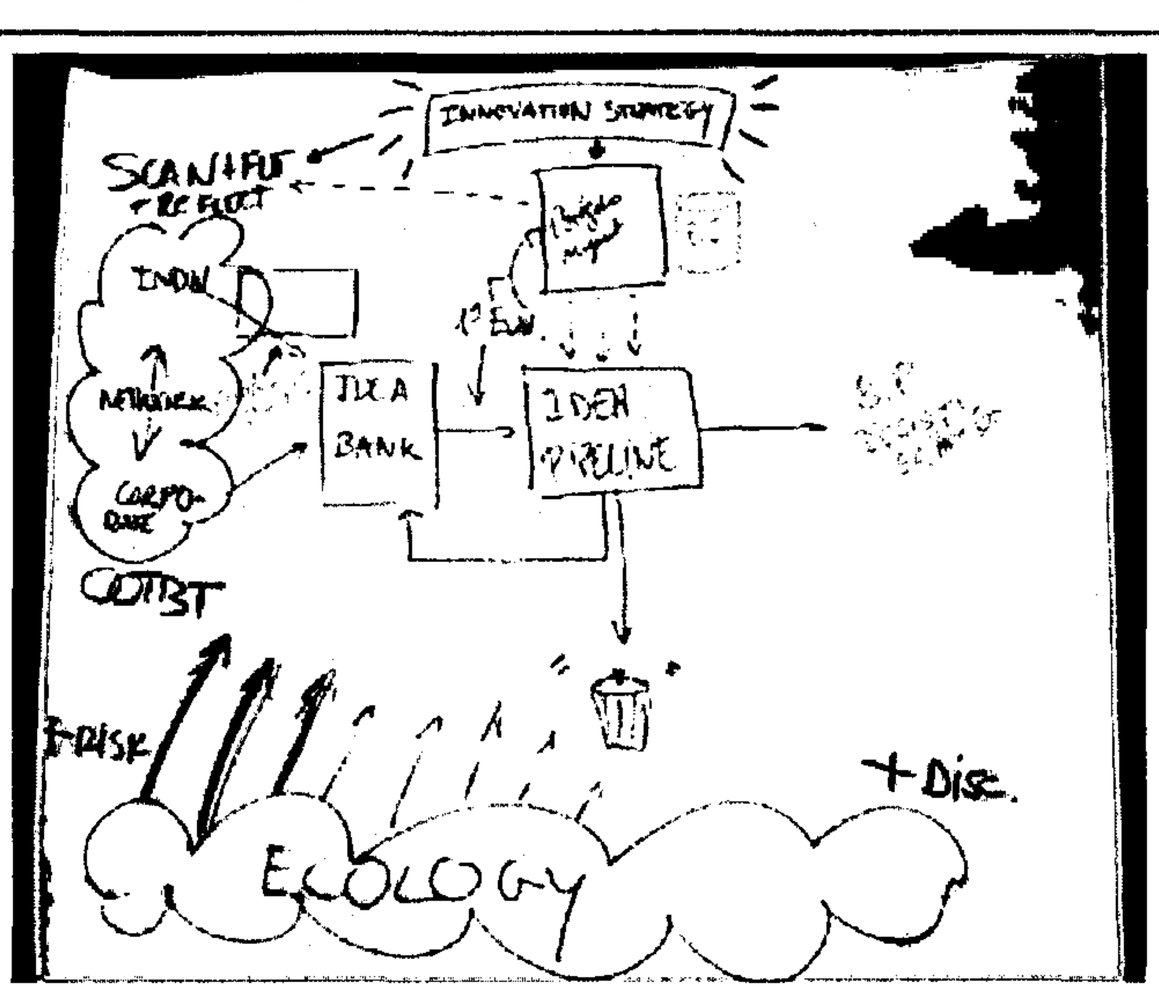


Figure 4-3: Case D's collecting broader stimuli to develop more radical ideas

A senior consultant from Case D used a graphical approach to explain how they have improved their ability to generate and identify radical and potentially disruptive opportunities (Figure 4-3). She illustrated how broader scanning, reflecting and 'futurising' with existing and new, personal and corporate networks had improved their ability to sense opportunities. Furthermore, by exposing their ideas and their 'ideas pipeline' to stimuli from the wider changing world and broader project selection approaches, they have delivered richer more grounded ideas. [D-Senior Consultant-OR-1071]

The notion that gathering and assessing large arrays of stimuli can fuel the innovation effort is not new but it is commonly overlooked and undervalued, especially when attempting to undertake radical or disruptive innovation (Morgan, 1993). Stinchecombe (1965) found that entrepreneurial insights and activities are difficult to undertake in conventional social arrangements. He claims that entrepreneurs thrive where the social and physical variation around them is at a maximum, because this allows them to arrange new social order that leads to new innovative opportunities. Since Stinchecombe's work, academics and industrialists have evolved improved systematic methods by which they can draw stimuli from the external environment – consideration is often given to extracting information from 'the wider organisational domain'. A management team's organisational domain encompasses companies and their customers positioned upstream and/or downstream in their vertical value chain. It also includes companies and their customers that supply complementary products or services within the broader value network. And it comprises of the companies that form direct or indirect competition, who possess similar core competencies or that satisfy comparable customer needs (Hamel, 2000). Morgan (1993) has stated that management teams who only consider stimuli from their own industry will be limited to delivering 'more of the same' innovation. Furthermore, O'Connor and Rice (2001) show it is from a wider domain that data and insights are more likely to be gathered to stimulate radical and potentially disruptive ideas and the recognition of potentially disruptive opportunities. Both these notions were supported by the data set. For example, a car manufacturer should gather stimuli from the wider domain of transportation; an oil company would consider the energy domain and a microprocessor manufacturer would cover the domain of information and communication technologies. The research participants believed, as do Rice et al (2001), that stimuli can come in the form of reflections, observations or predictions.

4.3.1.2 Monitor low-end and adjacent zero-consumption market movements.

> *Evidence: "... our technology roadmapping techniques have allowed us to plan and successfully enter the low-end of higher-tier markets... they've also shown us when our incremental improvements have begun to overshoot our average customers' needs –letting us know when to keep an eye out for new upstarts... there are always new groups of people popping up who don't yet buy our technology; we make efforts to watch the wider domain and to spot the places they're likely to crop up and make efforts to include them in our technology roadmapping exercises..." [RiM-Director of Technology-OR-1908]*

Despite the importance of opportunity recognition, much of the literature on the topic "focuses on the nature and importance of the phenomenon rather than on how to encourage the firms' capacity

to support it" (O'Connor and Rice, 2001: 98). O'Connor and Rice (2001) find that opportunity recognition for highly radical innovation is highly dependent on individual initiative and capacity, rather than routine practices and procedures of the firm. Opportunities for changing the basis of competition, within an existing industry, mostly appear in the low-end of the existing market (Christensen, 1997; Gilbert and Bower, 2002) or within adjacent markets that do not consume that industry's produce (Kaplan, 1999, Carrol, 1985). All research participants reported their belief that executive management teams who monitor these specific areas will be better prepared to recognise disruptive threats and to convert them onto opportunities.

4.3.1.3 Challenge convention and match potentially disruptive opportunities with market niches that offer a disruptive foothold.

> *Evidence: "... not knowing the answer is hugely valuable in the innovation process. So I encourage my guys and girls to be brave, to be comfortable when lost... It is not easy to challenge conventions but you have to, and the only way to bring them to life is to match unconventional product ideas with unconventional market segments... These niches of customers have to be delighted that you have come up with this idea, ... it's only with the base support of unconventional markets that you can move unconventional concepts into the mainstream" [RuM-Director of Innovation-OR-1246]*
>
> *"I believe that if you look back at the big breakthroughs in engineering, the genius has been in the big picture - seeing the world from a different perspective, challenging preconceptions, noticing the changes - not in the details." [B-R&D Director-OR-1453]*

In a longitudinal study, O'Connor and Rice (2001) found that "the technical discovery or insight [for a breakthrough innovation] typically originated with a scientist or engineer, who frequently was not prepared - either through training or life experience - to make the cognitive leap from a technical idea to an envisioned and articulated business opportunity" (p96). However, in the same study it was found that the 'opportunity recogniser' was able to link the breakthrough technical idea with a need in the marketplace – one that already existed, but was unfulfilled, or one that could be created. Managers involved in the research reported difficulties with pitching potentially disruptive opportunities to executive management for resources to conduct further investigations. To recognise the disruptive potential of the opportunity as advantageous, these managers stated that both they, and their top management teams, need to be prepared to challenge conventions – a notion also supported by Morgan (1993). Authors such as Lynn et al (1996) assert that probe and learn processes can be used to identify new customer niches for discontinuous innovation. If, whilst probing and learning, an opportunity recogniser has found a way to compete against non-consumption in an adjacent market or they can target customers who would be delighted by the concept because their alternative is to pay for functionality they will not utilise, then they will have identified a disruptive foothold market (Rafii and Kampas, 2002).

INHIBITORS:

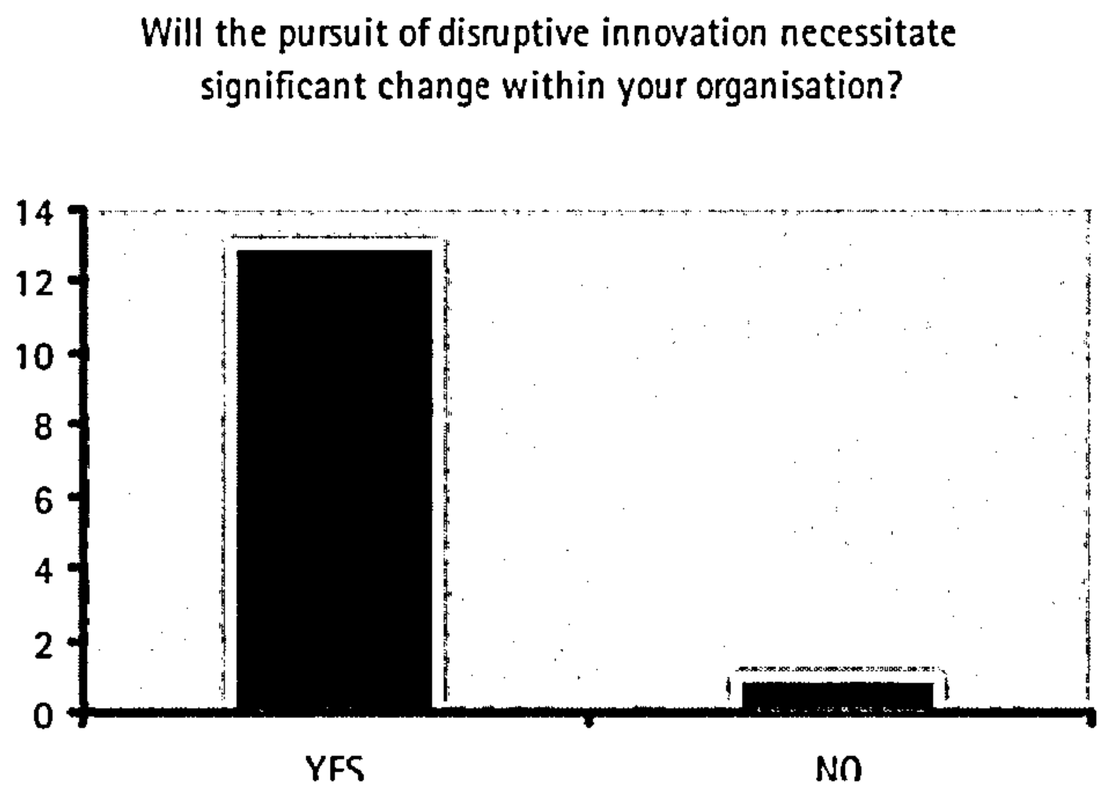
4.3.1.4 Restrictive assumptions about growth and the basis of competition.

Evidence: "I think that innovation at my company [Case A], right now, is stuck within a very narrow limited tradition – we have become our product, we all believed that we can just go on improving it. But it's bound to break-out sooner-or-later because there are people like me looking for ways to move it forward, where we secretly explore areas presently off limits to the business... if it doesn't, then this place will stop existing." [A-Director General-OR-2012]

Management teams who make the assumption that the basis of competition will not radically change, cause problems in the opportunity recognition phase (Ahuja and Lampert, 2001). Evidence was gathered from all for cases which showed that such a belief can permeate the business. Consequently, stimuli-gathering was seen to be restricted to the collection of trends and developments that could only support the advancement of current offerings. Moreover, employees rarely allocated time or energies to considering the hypothesis that their organisation may be facing obsolescence. It is believed that top managers who want to break these restrictive assumptions need to follow Kaplan's (1999) advice; they must infuse "a new common sense" (p21) one that ensures employees realise their company and its core technologies only have limited lifecycles – this will inspire urgency for, and commitment to, the pursuit of opportunities of a discontinuous nature.

4.3.1.5 The belief that disruptive innovation necessitates massive organisational change.

Evidence: At the outset of the first meeting of the research group, thirteen of the fourteen participants reported that they believed the pursuit of disruptive innovation would necessitate significant change within their organisations, especially within the power base of the business.



It was apparent that preconceived notions dominated and distracted the practitioners from the reality of disruptive strategies – a key restraint in the recognition of disruptive opportunities. [Team-Research Group-OR-49]

Arnold, Cooper and Robertson (1998) assert that management practitioners want to safely know their actions will deliver positive results; this desire means they mostly prefer stable and predictable working conditions. This investigation found most practitioners believe, whether or not explicitly stated, that the pursuit of potentially disruptive innovation will necessitate a revolutionary organisational change. Kaplan (1999) claims this occurs because most people associate discontinuities with "Industry Genesis" (p19) – one of a number of forms of discontinuous innovation which "... caries the highest uncertainty and risk" (p20). Therefore, a situation is created whereby the beliefs of management associate disruptive innovation with the perception of large-scale organisational turbulence; this propagates a resistance to the pursuit of disruptive innovation and inhibits the generation and recognition of disruptive opportunities.

4.3.1.6 Conventional market research techniques.

> *Evidence: "Our market research approach takes us to our existing customers and asks them: 'do you like this new idea of ours?'... it seems that we all do this [all four businesses within the research group], its seems that we all have difficulty accepting that we do not know what the market will eventually be for a really radical or a potentially disruptive innovation, so we just try to squeeze it into something that we already do..." [C-Senior Manager-OR-318]*

The participants reported the purpose of using market research techniques, within their new product/service development process, was to assess the size of market opportunities and to make go/no-go decisions on innovation options. Trott (2001) proposes that this form of market research may actually hinder the development of discontinuous new product development. It may be undesirable or impossible to conduct too much upfront market research with radical and discontinuous opportunities (Veryzer, 1998). It was found that practitioners within all four case organisations assessed potentially disruptive market opportunities using the same criteria as their sustaining alternatives. They were, in effect, forcing all new concepts into a sustaining model of innovation, which led to misunderstanding and the rejection of potentially disruptive options. Leifer et al. (2001) state and Trott (2001) predicts this occurs because customers cannot articulate their needs when they do not fully understand what is possible. This means it is unfeasible to predict how a potentially disruptive technology or offering will eventually be utilised by established markets (Linton and Walsh, 2002). However, Cooper, Edgett and Kleinschmidt (2001) are among many authors who claim a lack of 'upfront homework', which includes market research, is the

foremost reason why most new product development initiatives fail. Thus, investigation found that market research is important but its purpose should differ when pursuing innovation of a discontinuous nature. The management teams at both 3M (Hippel, Thomke and Sonnack, 1999) and Hewlett-Packard (Kalplan, 1999) are reported to have discovered this concept and have as a consequence improved their pursuit of discontinuous innovation with refined approaches. Rather than tools which approach known customers for go/no-go decisions, the practitioners involved in this research reported a need for tools to help explore, refine and validate the feasibility of ideas for non-consumers or over-looked low-end niche markets.

4.3.2 Opportunity Development:

DESCRIPTION: The capability to select newly identified, high-promise opportunities and to develop a selection of credible business cases that offer the potential for pursuing disruptive and sustaining innovation.

ENABLERS:

4.3.2.1 Only select projects with validated 'disruptive foothold'

Evidence: "Vital to the development of a business case for a potentially disruptive innovation is the definition of the initial target market... we've found that traditional customer segmentation just doesn't work... you have to consider what the people are trying to get done - not where they live, how much they earn, what colour skin they have - you need to match your new technologies to the jobs people are trying to do... only with a real initial target market can you establish a foothold for the technology..." [TH-Senior Consultant-OD-2138]

"The consideration of commercialisation issues in the early stages of the product development cycle proved to be the critical success factor in the delivery of radical [and potentially disruptive] commercial product offerings [KF-Commercialisation Director-OD-103]. ... building a relationship with a sample of the potential target population, and methodically exploring their 'pain', helps the team to develop empathy for overlooked or ignored people where radical [potentially disruptive] technologies can take root. This helps to quickly envision realistic solutions and establishes market credibility with [a disruptive foothold of] people who have a 'burning' unresolved need... It's often necessary to seek help to do this - we hire a real smart market research team." [KF-Commercialisation Director-OD-104]

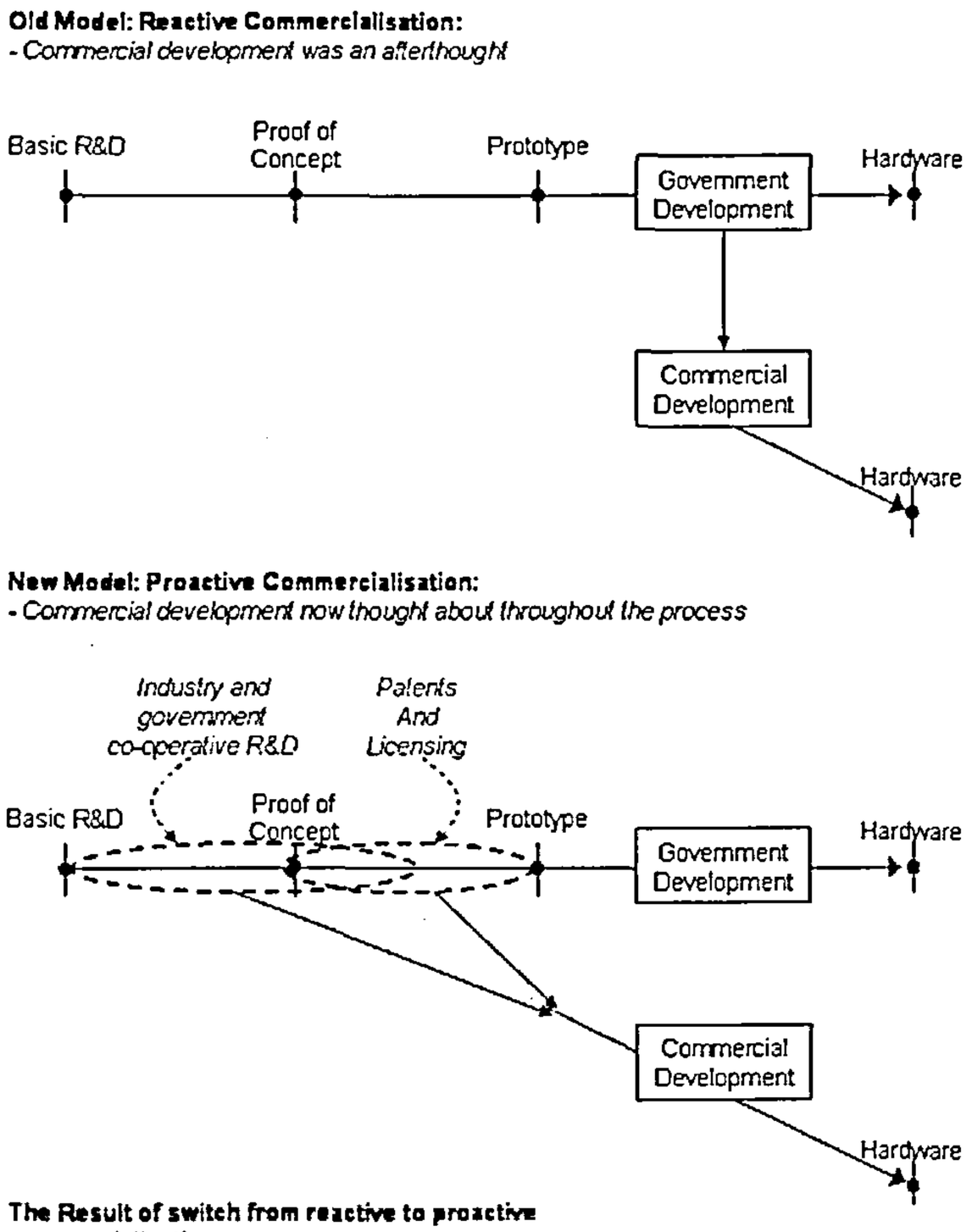


Figure 4-4: Thinking about commercialisation early in the process allows disruptive footholds to be discovered.

Interviewee 'KF' [KF-Commercialisation Director-OD-103] used the above diagram (Figure 4-5) to illustrate how his organisation transformed its ability to commercialise what he preferred to call 'breakthrough' technologies. As early as possible, KF would make stakeholders in the innovation process consider the question 'who would be the first niche of customers to need this new technology or approach?'. KF's organisation improved its commercialisation rates by over 500%.

Much of the literature that reports examples of disruptive innovations or revolutionary breakthroughs (e.g. Adnar, 2002; Afuah, 2000, Chesbrough, 2003; Christensen and Raynor, 2003; Dowd and Walsh, 1998; Schumpeter, 1975; Utterback, 1994; Wheelwright and Clark, 1992) does so by explaining the original route of the technology, approach or product. All, it would seem, are born in small niche markets and grow into their grandiose title of a breakthrough or a disruption. Thus rather unsurprisingly, data gathered from the expert interviewees shows that managers who send their opportunity recognisers 'back to the drawing board', until they have identified a well defined initial niche market, are more likely to develop high-promise potentially disruptive innovations. Most of the participants in the research believed that a thorough examination of the

unresolved burning issues within their industry's domain would help to identify a target 'disruptive foothold' population. This would be a niche of low-end customers or a segment that does not yet spend money in this industry who have, to date, not been satisfied by existing offerings. According to Christensen and Raynor (2003), and very much in line with the data gathered from the expert interviewees, the initial market should be a niche that large competitors will be happy to ignore or pleased to walk away from.

4.3.2.2 Business models that predict early profits with validated niche markets.

> *Evidence: ""I once identified, in my last company, a space in the market that'd been ignored and overlooked in the past. I expressed my interest and presented a disruptive opportunity for significant funding. It came as a bit of a surprise that I was met with a wall of scepticism and I asked 'why can't you accept it?'. The executive team said that 'we don't have a channel or the technology to enter that market'. I was so confident in the potential of the concept that I said to one of the very senior people 'well it is up to you make sure that this company can come up with these new channels and technologies'. So, after a little more debate and negotiation, I was given a team to investigate the development of a simple but innovative solution for a small group of these, these ignored customers... I was told to make money and become self sustaining as quickly as possible - to prove the idea would work. This kept our focus on a narrow market and stopped the temptation to over deliver. This company [Case C] needs to learn from these lessons, we tend to put too much into our solutions and we tend to want to go straight to big markets - this definitely stops us applying disruptive approaches" [D-Area Manager-OD-2065]*

It could be concluded from the data that the pursuit of disruptive innovation will be enabled if management teams have the ability, and desire, to support the construction of a specific kind of business model that predicts early profits within a validated niche market[1]. It is believed that potentially disruptive technologies or offerings should be based upon the construction of a business model that aims to make early profits in one of two ways: (1) With the discount prices required to capture customers in low-end markets. (2) With the maximum possible prices that will be endorsed by small emerging markets of people willing to migrate from non-consumption. This notion is very much in line with Christensen's work (e.g. Christensen, 1997; Christensen and Overdorf, 2000 and Christensen and Raynor, 2003) and the findings of Gilbert and Bower (2002). All the expert interviewees mentioned or implied the importance of this enabler and all four case study organisations note their inability in this area (either through prevailing motivation, culture or experience) as a key reason why they fail to develop potentially disruptive business opportunities.

[1] The term business model is used in accordance with Hamel's (2000) definition –the unique configuration of resources, processes, a product/service strategy, customer interface and the value network that brings a business concept to fruition.

The data and the findings of Kassicieh et al (2002) also show particular attention must be given to distribution channels and processes needed to realise the business model. Many of the participants believed if the prevailing organisational system will not provide the necessary support, then options such as partnering, outsourcing etc. should be considered – a belief explained in depth by Christensen and Overdorf (2000) and Christensen and Raynor (2003).

4.3.2.3 Plan for emergence.

> *Evidence: "A really important part of the delivery of breakthrough innovation, in my experience, has been the ability to throw top-down planning out of the window... you need top-down support to conquer the initial market, but then you need to set up a team that can flex and respond to emergent opportunities and demands as they come out of the woodwork... however, there comes a time when the breakthrough can become mainstream and looking for new avenues becomes inefficient, that's when you need to bring back top-down planning and deliberate decision making" [RM-Director of Technology-OD-1915]*

A key difference between the expert interviewees and the participants from the cases was the willingness of senior management to accept emergence as a valid plan. The importance of emergent approaches is discussed by Mintzberg and Waters (1985) and Burgleman (2002). And it was concluded from the data analysis that a management team will be better placed to enable a disruptive innovation if they accept their initial business model and plans for a potentially disruptive customer offering will not be the one that delivers long-term success. In accordance with Kassicieh et al (2002) and Leifer et al. (2000), it was found that strong business cases are needed for initial niche market penetration; however, if the insurgent is going to disrupt existing key players they then must remain flexible and facilitate the emergence of a viable strategy to deliver the disruptive potential of the concept. Evidence presented by Leifer et al. (2000) demonstrates that management teams can plan for emergence by continually monitoring the performance of their radical innovation initiatives and continually checking all major assumptions. These managers are said to be utilising a multiple opportunity recognition approach (Leifer et al., 2000; O'Connor and Rice, 2001) by responding to emergent demands. Therefore, it is believed that opportunity development teams can plan to embrace emergent approaches thus supporting the emergence of viable strategies.

INHIBITORS:

4.3.2.4 Selecting opportunities which target satisfied customers.

> *Evidence: "... it costs a lot of money to follow new ideas; it costs even more to follow these radical or disruptive ideas, because you have to convince your customers to do something different... sometimes, this is just too much of a gamble." [B-R&D Director-OD-890]*

At the onset of the research the above sentiment was echoed across all four cases. Management practitioners from each business reported failed attempts to develop potentially disruptive concepts that could be adopted by a mainstream market. A commonly stated sentenced was: "if only we could get them [the mainstream customers] to change their behaviour".

The management teams from all four case studies reported a common behaviour that inhibited the initiation of the opportunity development phase. They reported that when selecting opportunities for investigation they had, in the past, focused their selection upon incremental innovations and/or potentially disruptive opportunities that target customers who already use satisfactory products. The main reason they gave was the attractive size of the markets. However, research by McDonald et al (2001), Moore (1995) and Leonard and Rayport (1997) has shown that consumers need a compelling reason to buy and it is a mammoth task to persuade people to change their purchasing habits. Therefore, it would seem that managers who want to challenge existing customer priorities increase the potential that they will be setting themselves up for an unwise use of organisational resources. This issue is linked to the inhibitor presented in section 4.3.2.6, where the impact of narrow opportunity selection is felt during the development of business cases. Furthermore, the reasons for top managers focusing upon such projects can be explained by the effect of restrictive mental models (Morgan, 1993; Senge, 1990; Swan, 1997; Tripsas and Gavettit, 2000), this issue is discussed at length in the proceeding chapter.

4.3.2.5 Performance guided by traditional processes.

Evidence: "... our quality management processes enforces a get it right first time policy... this is good if you know the customer, but bad if you want to test new ideas in new markets." [A-Quality Manager-OD-643]

"Our traditional market research techniques take you to existing customers and asks their opinions on new ideas... if it's an idea that's a bit 'out-there', they always come back and say we don't want that; that's why we don't use them any more... we've discovered more empathic approaches – these help a lot" [D-Divisional Head-OD-112]

"I completely support rigorous engineering approaches in new product development but I'm concerned that the way we manage our innovation projects may be letting genuinely radical - and maybe even disruptive innovations - slip through the net... you need to think somewhat differently to make these things happen, you need to inspire and support different approaches." [D-R&D Director-OD-1454]

It was found that practitioners within the cases contributed to a failure to pursue disruptive innovation when they relied upon their traditional practices of project selection, market segmentation and quality assurance for all their innovation activity. Managers within all four companies rarely selected initiatives outside of their core activities – a tendency observed by Ahuja and Lampert (2001) and Chandy and Tellis (2000) that restrains the pursuit of non-linear innovation – nor did they display any willingness to self-cannibalise - a tendency considered as

essential when organising for truly radical product innovation (Chandy and Tellis, 1998; Grove, 1996). They failed to segment markets in new ways to "... mirror the jobs that customers are trying to get done" (Christensen and Raynor, 2003:289). And they still applied the prevailing quality targets and quality approaches that were embedded within their organisational practice – whether or not the products and services needed them. Consequently, business case development was limited to the traditional formula of incremental innovation.

4.3.2.6 The development of high-risk-high-investment business cases.

Evidence: Case A presented to the research group a new concept in protective helmet design (Figure 4-6). It was heavier than most helmets and it was not as strong, thus it was considered to be of lower performance than their conventional product range. However, it offered new functionality - a rear view system. The advice from theory on disruptive innovation would be to find a niche market for the new concept, consisting of a group with a compelling reason to buy the product, and to organically grow sales from this disruptive foothold. Instead, Case A had developed a business case that would place the new concept on the same shelves as industry standard products. This generated two main problems. To compete directly with the existing products required high investment, this meant that they needed significant sales from the mainstream market. However, they were asking customers to change their purchasing behaviour, without specifically targeting niches that would benefit from the product's new offering.

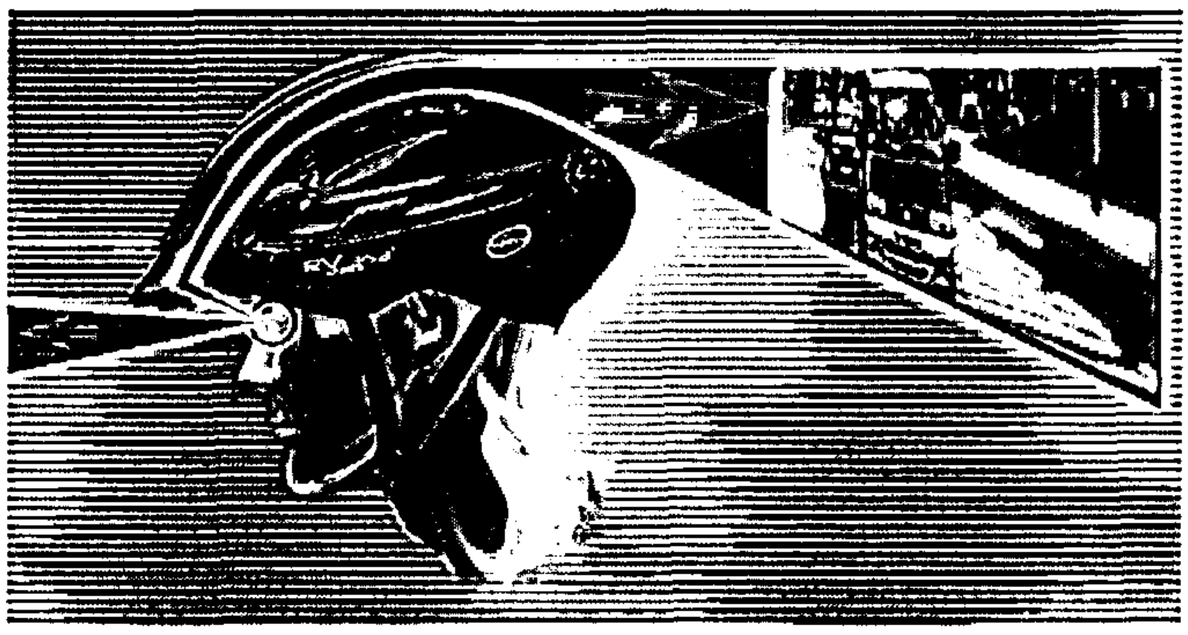


Figure 4-5: : Case A's Rear View Helmet

Case A was not alone in this approach. All four cases reported the development of high-risk-high-investment business cases in their past attempts at pursuing industry changing innovation and all four reported that these business cases were either rejected or failed in the latter stages of the innovation process.

This inhibitor focuses upon the failure to develop appropriate business cases. Four of the seven expert interviewees and practitioners from all four cases, reported occasions where their organisations had developed business cases, which resulted in failure, for what could be considered with hindsight to be potentially disruptive opportunities. In almost all of these reports the business case required massive investment and long periods of payback, all of which planned to immediately

tackle the incumbent organisations of established markets. The data shows that the participants had experienced two significant problems with this approach. Firstly, the placement of a potentially disruptive opportunity into a sustaining business model is highly risky, as to make the relatively untested innovation look preferable to its established alternative - an alternative that consumers are already happy to use - requires massive investment (a finding consistent with one of Christensen's (1997) and Christensen and Raynor's (2003) key discoveries). Secondly, it was reported that these plans assumed the development teams had identified the definitive strategy for the potentially disruptive technology or offering. Burgleman's (2002) insights, into the micro-processing giant INTEL, show how this is almost impossible. Instead long periods of payback allowed the cases' product managers to pursue the wrong strategy for too long. The consequence of the case study organisations' experiences with the failure of high-risk-high-investment business cases led to a reinforcement of fears of massive organisational risk when pursuing disruptive innovation. This also contributed to the earlier rejection of future potentially disruptive opportunities. Alternatively, the expert interviewees reported such experiences contributed to refinements of their planning and investment processes.

4.3.3 Solution Development:

DESCRIPTION: There are two main phases to solution development. Firstly, the capability to select business cases with *significant* promise for delivering both potentially disruptive and sustaining innovations. Secondly, the capability to initiate and support new product/service development projects, *in order to* deliver pre commercial offerings across the full range of innovation activity – incrementalism to disruption.

ENABLERS:

4.3.3.1 Select business cases that have segmented the market by jobs customers are trying to get done.

> *Evidence: The "Palm Pilot' is often viewed as a disruptive innovation instigated by MB's organisation, when asked about this he stated: "It was mainly a re packaging of an existing technology, not really much of an innovation in the sense of a radical invention, we just designed, created it and put it together in a better way where people would actually use it... we just picked up on the real need of a group of people and it grew from there" [MB-Head of Ergonomics-SD-2140]*

It was found that senior managers who are brave enough to shape and select high-promise potentially disruptive business cases are a major enabler in the early phase of solution development. It is believed they must select business cases that have segmented the market by the jobs that customers are trying to get done and identified overlooked small market niches that can become a disruptive foothold. Allen et al (1999), specialist practitioners in break-through product design from the UK based consultancy 'WhatIf', highlight managerial bravery and very similar opportunity selection criteria. Furthermore as previously stated in Section 4.2.2.1 it would appear that all disruptive innovations are born in small market niches, whose members had a compelling reason to buy the new technology or offering.

4.3.3.2 Stick to the target niche and do not compete against existing customer priorities.

> *Evidence: "... we did have some major problems with the software that we now sell. We knew it was a great offering, because it had worked in [our parent company] and our first customers in the trial phase had been overjoyed... but I guess we got over excited - because before we went for the full launch [of the spin-off company] we began to invest a lot of time and money into improving the package... We were introducing functions that we thought our customers would eventually like, because they were already trying to do these things with inferior software, and found that we had missed what our initial market actually needed – a simple solution... this was a major lesson; it took ages to recoup that investment, we should have stayed focused upon responding to our first customers." [C-Senior Manager-SD-1500]*

Development teams who say they need to convince their target customers to change their behaviour, rather than targeting a niche of people with a compelling reason to buy, create a significant drain on resources and inhibit new growth businesses (Moore, 1995) and disruptive innovation (Christensen and Raynor, 2003). Thus, it was concluded by a majority of the participants that management practitioners can enhance the pursuit of disruptive innovation by preventing the progression of such teams.. The data set contains stories from each of the expert interviewees of development teams that had strayed away from the initial well-defined market entry point of a potentially disruptive innovation. In each case the team had begun to compete against customers' existing and obvious priorities – this led to loss of resources and either serious project set-back or concept failure. The author facilitated a discussion regarding these findings with a multi-functional group of managers from all four case study organisations. They concluded that keeping solution development teams focused on providing more convenient or inexpensive solutions, to the problems of an initial niche market, will better enable the delivery of potentially disruptive solutions. This was supportive of commentary made by Rinne (2004) and the findings of Allen et al (1999) and Christensen and Raynor (2003).

4.3.3.3 Plan to accelerate the emergence of a viable strategy.

> *Evidence: "... when a technology with disruptive potential had proved itself, either in testing or in a small market, we had a process to develop a workable strategy for disruption based on a version of technology roadmapping that we'd adapted... firstly, we'd say that we want the budding initiative to reach a certain financial target, and then we'd come up with a few ways the initiative could reach this checkpoint and list all the technical, market and product assumptions that'd need to be true for each to happen. Secondly, we'd prioritise this list - the assumptions most difficult to prove or least likely at the top and the 'givens' at the bottom. Then we'd attempt to test or investigate the highest-priority assumptions - without actually building very much or investing masses of cash. This way, we'd see which assumptions proved to be reasonable, which were crap, and a strategy would become clear - we'd be able see how we could move upstream or how we could enter new markets... Finally we'd create a plan using a technology roadmap and then spend money developing the required product... yeah, it was pretty emergent, I guess; but only in the initial tentative phases when we needed to be flexible." [RiM-Director of Technology-SD-1892]*

It was concluded by the participants that they need to ensure, at the onset of a potentially disruptive innovation, their development teams remain unsure of the eventual viable strategy. They believed this would enable them to deliberately focus the pre-commercial offering upon the appropriate initial low-end or new-market niche. Equally, this would enable the development team to form a base of experience with the new technology or customer offering to create a platform for future growth - insights into how the technology or offering could be utilised in the future within other larger established markets. The participants felt they need to better understand how they can use the experience gathered during this early process to support and plan for accelerated emergence of a viable strategy. The findings of McGrath and Macmillan (1995) and Lynn, Monroe and Paulson (1996) suggest that discovery driven planning and probe and learn processes are suited to this approach.

INHIBITORS:

4.3.3.4 Restricting autonomy of development teams.

> *Evidence: "I have heard many colleagues say: 'I just wish that my team [a product development team] could just be given some resources and a profit target and be told now go and get on with it'... because we are facing hard times right now, our top management are obsessed with control... so people in product development have to complete many forms, explain all their actions and focus upon 'core values' [participant laughs ironically] they have no creative freedom, this stops us doing the things that we used to be good at – making great new products" [C-Senior Manager-SD-601]*

Moore (1995) shows how the 'early market' – the first group in the technology adoption lifecycle to buy a new piece of technology – will purchase a new type of customer offering only if it addresses a specific need that is currently either overlooked or over-fulfilled. His research concludes that to attack this initial market a company must have deep empathy for the customers' needs – a notion

also supported by empathic design specialists Leonard and Rayport (1997)[2]. Much of this activity can be facilitated by providing product development teams with the necessary autonomy. The literature indicates that development teams without the autonomy to 'probe and learn' (Lynn et al, 1996) or to maintain flexibility of leadership of tasks (Dev Amar, 2001) will not prosper during this uncertain stage. They will, in effect, be unable to respond to the needs of the early market as they will be constrained by their organisations' inertia (Ahuja and Lampert, 2001). A common theme, raised by the participants from the cases, when discussing the development of radical or potentially disruptive pre-commercial offerings was: the need for more autonomy. Practitioners from all four cases reported they felt constrained to focus upon their familiar markets, their mature technologies, or their standard approaches to solution development. They believed if they were going to create a disruptive innovation to suite the needs of an early market they must have more autonomy to explore unfamiliar areas. Many conveyed their belief that new performance measures could be introduced to monitor and support such activity. Likewise, psychologists also support autonomy for creative acts in the workplace, as long as they are recognised and supported in staff evaluations (e.g. Deci and Ryan, 1987).

4.3.3.5 Failing to match resources, processes and values.

Evidence: Following a meeting of the entire research group, the author read an observation from his case notes to the participants from Case B. The head of the innovation team and one of his senior engineers confirmed the observation to be correct:

"The innovation process at Case B:

- *Progresses painstakingly – through the collective efforts of dedicated research teams.*
- *Progresses intentionally – deliberately building upon the past to the next generation of products to push them into the next phase of their future.*
- *Attempts to screen out 'chancers' and bad ideas by using 'intellectual safety in numbers' – this results in support for the established way of doing things and ensures that the traditional processes are kept in place.*

However, this leads to major problems when trying to develop business cases for disruptive innovations: if an inspired individual comes up with a radically new idea [such as a potentially disruptive innovation] or a concept that doesn't fit with established norms, he will find it hard to get support in terms of resources and processes – the values of many managers do not support this either" [B-Researcher Observation-SD-324]

[2] Moore's (1995) findings also show as sales of the new offering grow, and it is adopted by the early majorities, the organisation has to focus less on empathic understanding and more on the efficiency of distribution channels and manufacturing – rather like a commodity product.

It was reported by almost every participant from the case study organisations that managers responsible for allocating resources (human and financial), managing processes and fostering organisational values (the basis on which employees make their prioritisation decisions) fail to consider the needs of potentially disruptive development projects. Authors such as O'Connor and Rice (2001), Lewis Cosier and Hughes (2001) and Brown (1991) show how senior managers either fail to assign the most appropriate project manager, or how they allow prevailing organisational processes and values to inhibit the progression of potentially disruptive concepts (these issues are discussed in more length in the proceeding chapter).

4.3.3.6 The wrong organisational home for the project.

> *Evidence: Three common phrases that came from the participants when discussing failed attempts to develop potentially disruptive concepts were:*
>
> *"we should have allocated our resources differently, so that we didn't burden ourselves with massive return on investment expectations";*
>
> *"perhaps we should have sought outside partners" and*
>
> *"perhaps we should have tried to set-up a team outside our normal day-to-day business".*
>
> *[Aggregation of case data- Researcher Observation-SD-1989]*

In early discussions each case displayed major reservations admitting that they may not have the skills to develop potentially disruptive solutions or that their day-to-day activities may actually kill these concepts. However, for these reasons research has shown that development projects for potentially disruptive innovations are not always best delivered in-house. For example, 'spin-outs', 'partnerships', 'joint ventures', and 'spin-ins' may be better propositions for these initiatives (Hellman, 2000; O'Connor, and Rice, 2001; Rothaermel, 2001). After the author presented findings from academic papers (on the problems that organisations can face with potentially disruptive development projects) all four collaborating cases reported times where they believed their in-house pursuit of new product/service development and/or commercialisation may have been responsible for killing some potentially disruptive initiatives. Despite major reservations surrounding both the generation of autonomous groups and the sharing of intellectual property with unknown parties, it was concluded that the wrong organisational home is an inhibitor of solution development that can be avoided.

4.3.4 Exploitation:

DESCRIPTION: The capability to select the best range of high-promise pre-commercial offerings and to profitably pursue two types of exploitation strategy – top-down strategies, for

deliberately driven sustaining innovations, alongside the nurturing of emergent strategies for potentially disruptive innovations.

ENABLERS:

4.3.4.1 Select solutions that are good enough to win small, win early, and win often.

> *Evidence: "One of the most futuristic applications of silicon chips is 'exploding silicon'. I understand this was discovered when some researchers were mucking about... the discovery of chips bouncing around tables with little explosions has led to the idea of retro rockets for steering real small MEMs (these devices are basically rockets on a chip) and ideas for a much better air bag inflator. The things that were first for fun have taken on surprisingly disruptive market applications - which one will work out? I have my ideas. The trick is to not over engineer the new concept; you have to try to package new discoveries in places where you can test if they're any good without investing millions of dollars... a solution that is good enough to satisfy a group of people who were previously unsatisfied, that can then be taken into an adjacent market has a much better chance of disrupting the mainstream than a massive investment into a totally new infrastructure. Exploding silicon? It should take on air bags before MEMs, this way the manufactures are a lot more likely to make money out of concept. [FF-CEO-Exp-2108]*

The data shows that management teams, who are happy to select solutions for exploitation which embrace a 'minimally accepted features set', will enable the pursuit of disruptive innovation. The expert interviewees stated that a critical success factor of disruptive innovation was the prevalence of managers who accept that they will not be able to solve every aspect of their niche market's burning issues at the first time attempt. Therefore, disruptive innovation enabling organisations appear to not compel their development teams to build the 'ideal solution'. As long as the solution encompasses the main subset of features that the customers require - and the customers are willing to pay for it - the organisation can begin exploitation. Warren East, the CEO of ARM - of one of Britain's leading technology companies, states "... it's much better to have some business with real customers than lots of plans for a huge business with potential customers." (Brennan, 2003b:4). Hamel calls this: selecting pre-commercial offerings that look set to win small, win early and win often – he also states this is essential to building a "revolutionary ready organisation" (p10). Brown's (1991) research indicates it is in these initial niche markets that organisations will develop invaluable experience and knowledge of the potentially disruptive offering and this will open the doors to rapid consumer driven improvement and the path to disruption.

4.3.4.2 Be impatient for profitability but patient for growth.

> *Evidence: "... its difficult to actually see what the discontinuities actually are or where they could be... What might be mine or my client's discontinuity might be the market places incremental change. It's really only when your innovation hits the streets do you understand the true nature of the discontinuity... the key is to make money as quickly as possible but to be patient for the big paradigm shift." [MB-Head of Ergonomics-Exp-2150]*

Christensen (1997) and Hamel (2000) show once a potentially disruptive pre-commercial offering has been selected, the product managers must be impatient for profitability within the initial target niche market. The data from expert interviewees appears to indicate that their organisations (or their clients) have not suffered significant strategic mistakes because using this approach ensures that product managers will not patiently tolerate long-term losses. This is unlike cases A, B and C, who report many examples of an impatience for growth before profit and the unwitting pursuit of strategic error. Thus it is believed that product managers can aim to foster organic growth, and the emergence of a viable disruptive strategy to enter existing markets, by remaining patient for growth, whilst making money quickly and deliberately from the initial foothold market. O'Connor and Rice (2001) have shown how such an approach allows product managers to learn invaluable lessons, which can guide responsive actions to emergent demands.

4.3.4.3 Do not cling to initial success and abandon concurrent development.

> *Evidence: "... we prove the validity of new concepts with prototypes and demonstrators and then take on our first stage markets... Employees are then supported in the process of identifying and combining future market needs and the new technologies to breakout of the first stage market – to create the new disruptive product concepts... what delivers success in the initial phase is almost always guaranteed not to be a key performance driver as the concept matures." [TH-Senior Consultant-Exp-1319]*
>
> *"... we're now working on a number of breakthrough technologies and believe that no creative idea can be developed to a successful innovation if it does not have the adequacy to fit a market... the problem is that everything has to be completed in a serial way so it takes longer - you see, we use parallel development practices for our incremental innovations... but these do not work for the radical stuff..." [TH-Senior Consultant-Exp-1318]*

All the managers involved in the research accepted that if they cling onto the strategies, skills and processes that deliver success in the initial disruptive foothold market, they will fail to develop competencies for where money will be made in the future. This belief emerged when discussing several examples of disruptive innovation and probing the origins of the case study companies themselves. Thus it was concluded that to enable the pursuit of disruptive innovation, management teams must accept that the disruptive business they build will not be the one they started with. Moore's research (1995, 1998, 2000, 2002) in silicon valley shows when the path to disruption opens throughout the exploitation phase, massive shifts in strategies and product lines will emerge.

A notion also contended by Tushman and O'Reilly (1997) through their presentation of technological 'S-Curves'. Therefore it is believed management teams must have the ability and agility to select, validate and then rapidly adapt manufacturing, marketing and distribution processes. Further adding to difficulties was the practice of concurrent development preceding and during the exploitation phase. The traditional benefits of concurrent development, which include cost savings, improved time-to-market, and enhanced manufacturability (Handfield, 1994; Krishnan, 1996), appear to not accumulate when the product offering or the underpinning technology is unproven and customer requirements are uncertain. The four cases included in this study and the organisations of the expert interviewees used concurrent practices to a greater or lesser extent, yet in unproven and uncertain environments, a serial, longer development period appeared to be necessary to 'iron out' difficulties. The problems of using concurrent development for radical or breakthrough product development were predicted by the mathematical models of Aitsahlia and Johnson (1995) and also witnessed in United States and Japan, by McDermott and Handfield (2000).

INHIBITORS:

4.3.4.4 A lack of empathy for the disruptive foothold market.

> *Evidence: "Having a breakthrough insight is about having a fundamental penetrating understanding of a piece of human behaviour – in my business it's usually consumer behaviour – which nobody else has yet had. It's this that will enable you to spot an opportunity or an angle that nobody else has found or used yet... Insights don't come with solutions but building empathy for a need or a group of people will deliver the breakthrough idea... no empathy, no breakthrough."*

An analysis of Britain's fastest growing unquoted technology companies, from the Sunday Times Tech Track 100 league table, shows that success has been built upon an ability to deeply understand real customer needs (Brennan, 2003a). In spite of a global technology down turn, many of these companies are fast growing insurgents, prime to disrupt the mainstream and of those thriving the most, success is premised upon a core customer focus (Brennan, 2003b). This investigation found that managers struggle to exploit potentially disruptive solutions, when they do not have real empathy for the burning issues that they are trying to address. Customers in the initial foothold market will require significant attention and significant understanding, much more for instance, than when selling a commodity product to a mass market – a notion propagated by Moore (1995, 2002). Therefore, selecting pre-commercial solutions that do not contain elements of empathic design will inhibit successful exploitation; the findings of Leonard and Rayport (1997) also support this conclusion.

4.3.4.5 A pre-emptive focus upon legal issues and standards.

> *Evidence: Case B presented a concept with long-term potential for disrupting the electricity energy sector. However, their obsession with keeping the proprietary position closed was inhibiting them from overcoming a major technological barrier, which rather that being resolved in-house, could have been solved in partnership. This in turn was slowing development of the first prototype, adding costs and increasingly making small niche entry markets look less attractive.*

When attempting to make progress with potentially disruptive innovations a common behaviour of the senior management involved in the research was an eagerness to focus upon seemingly more tangible deliverables. Therefore, legal status, standards and protection of intellectual property took front stage and overshadowed the more intangible issues of developing relationships with partners and building empathy for an initial foothold market with a compelling reason to buy. Thus, it was observed that managers can inhibit their organisations' pursuit of disruption when, at the outset, they try to control the market with a focus on legal issues and the development of standards and patents. Although more frequently mentioned by the large case organisations, it appears that keeping proprietary offerings closed for too long or seeking industry standards when the customer offering is not 'good enough', can inhibit product managers in two ways. Firstly, overly restricting or not sharing knowledge about an emergent concept, across the supply and value chain can result in inaction from a necessary network of partners, suppliers and/or distributors (also noted by Rothaermel (2001), Phaal et al (2004) and Rothwell (1995)). Secondly, this focus can distract from attending to changes in customer preferences for performance and distribution channels (also noted by Christensen and Raynor (2003) and Rogers (1995)).

4.3.4.6 Improper organisational homes for projects.

> *Evidence: With the exception of Case C, traditional approaches to new product development constrained managers to develop and exploit all innovation initiatives from within their existing organisational framework. Despite Case C's efforts to use a spin-out incubator approach their managers reported that they suffered from an "... overbearing parent problem" which "... creates an unspoken demand for fast ramp-up and high-levels of scalability." [C-Senior Manager-Exp-1494]*

The overwhelming traditional approach to innovation constrained the managers involved in this research to in-house exploitation of potentially disruptive innovations. It has been recognised for some time that sustaining innovations, which also complement core business, should be developed and exploited by central in-house teams (e.g. Knight, 1967; Rothwell, 1995). However, a potentially disruptive innovation may or may not fit well with prevailing organisational processes or values (Rice et al, 2002). Christensen and Overdorf (2000) show that in management in these cases could consider a spin-out commercialisation team or even a separate spin-out organisation for both

development and exploitation. Tushman and O'Rielly (2002) assert that two different organisations can be located within one business unit. Regardless of the approach taken it would seem that without independence the initiative can suffocate and die. For a detailed discussion of the advantages and disadvantages of spin-offs etc. and practises of where to house potentially disruptive innovations see Tushman and O'Rielly (2002).

4.3.5 Innovation Strategy:

DESCRIPTION: The capability to align strategic intent (the organisations vision and plans for the future) and strategic action (the output of the resource allocation process) in order to deliver the simultaneous pursuit of sustaining and disruptive innovation.

ENABLERS:

4.3.5.1 Facilitative resource allocation processes.

> *Evidence: "... it seems to me that if you want to open new doors to new thinking you have to be outside the mainstream with a pot of money; you have to invite people to join you and you have to reassure them that it won't damage their careers. This must be done with a holistic understanding of what's going in the business and you have to make sure that the conventional activities of the business cannot steal these resources at any time" [B-Head of Innovation Team-IS-1488]*

The ability to make investment decisions in a holistic manner was one of the key reasons given by six of the seven expert interviewees for their executive management team's apparent ability to use resource allocation procedures to align strategic action with the strategic intent. The literature provides support to the importance of holistic decisions making. Cooper (1999) and Cooper, Edgett and Kleinschmidt (1999, 2000 and 2001) provide compelling evidence to suggest that portfolio management tools can reduce project gridlock, maximise return on investments, improve strategic alignment of innovation activity and improve the balance of resources across the metrics of risk, lead-time, and innovation type. They conclude these benefits are achievable because portfolio tools aid holistic decision making. Hellmann (2000) espouses that investments should only be made when full consideration of strategic congruence has been taken regarding all investment options in relation to core business activity. He provides a model that could assist executive management teams, and R&D departments alike, to consider the structure of investment activities (e.g. joint ventures, sole ownership, and spin-outs) stating that this approach also requires a more holistic consideration of the business. Bussey (2002) and Luehrman (1998) both provide methodologies for management practitioners to apply real options pricing to investment opportunities. In particular,

Luehrman offers evidence to indicate that real options valuations could be the most effective method for evaluating innovation opportunities, especially when options are mapped graphically onto purpose built matrices to assist with holistic decision making. Thus resource allocation approaches that are based upon holistic decision making may be a key facilitator in the pursuit of disruptive innovation. A discussion was held with the entire research group regarding the resource allocation issue and the pursuit of strategies that include disruptive innovation. The participants believed that ideal funding mechanisms would enable a balanced resource allocation approach, throughout the innovation pipeline, to a range of sustaining and potentially disruptive innovation activities. Yet senior members of each case study organisation believed those with access to their organisational 'purse strings' were without the mechanisms to fund the broader activities of both sustaining and disruptive innovation. They also reported a lack of an holistic view of innovation options. Executive managers interviewed from the case study sites believed their 'hands were tied' with stakeholder expectation and ill-fashioned project assessment tools. The case study participants concluded that organisations, which have only delivered sustaining innovations in the past, must be ready to abandon their project selection methods and adopt more holistic resource allocation approaches. Noda and Bower (1996) also support the notion that strategy should be delivered through the process of resource allocation.

4.3.5.2 The support of sustaining and disruptive innovation with flexible cost structures and targets.

> *Evidence: "Innovation has been one of our successful features, but could it be done better? YES - I think we could get more 'bang from our buck' with less rigid attitudes. By being a bit more adventurous with how we set targets for spending and ROI [return on investment], we would be more open to ideas that are more maverick than methodical... but right now we are not revolutionary because we are being stifled by practicing 'safe' innovation and 'safe' R&D." [B-Senior Programme Manager-IS-96*

Grove (1996) states strategic action is, in effect, the output of the resource allocation process. Following his review of successful radical innovators, Bott (2002) supports Grove's statement in his declaration that organisations should possess 'fractal innovation portfolios'. He states that portfolios of innovation activity should be completely representative of the organisations' overall strategic intent to pursue business improvement alongside new wealth creation. Early results from the innovation effort effect decisions to commit resources, decisions to commit resources are based upon positive operational results and as such target setting becomes important (Noda and Bower, 1996). However, Leonard-Barton (1992) and Ahuja and Lampert (2001) advise that radical and breakthrough (and by implication potentially disruptive) innovations are often not pursued due to misaligned organisational targets. Noda and Bower's (1996) observations indicate that the

perception of early operational results and how resources are allocated is dependent upon the targets and the cost structures that are set by the management of the business. "In the case of a new business development that involves high degrees of uncertainty, the iterations of the resource allocation process generate a pattern of escalation or deescalation of a firm's strategic commitment based on early results from operations that confirm or disconfirm the premises of the first investment and the credibility of the champions." (Noda and Bower, 1996:187). Target setting is, therefore, of concern to many authors in the field of disruptive innovation. This importance of targets was raised by four of the seven expert interviewees; they explicitly spoke of the need for flexible targets for both profit margins and minimum ceilings for opportunity size if pursuing both sustaining and disruptive innovations in parallel. They stated flexibility allows attractive profits to be made at low price points or in small, emerging new-markets from the very beginning of a disruptive venture. Without such flexibility, potentially disruptive innovations are subject to the stringent targets of core operations. After discussing these viewpoints with the research group, the senior management involved from cases A, B and C, concluded that they must find a way to integrate the notion of flexible cost structures and targets into their businesses (case D stated that they were more likely to introduce this concept to their clients). Thus the data indicates that an innovation strategy underpinned by flexible cost structures and targets is a significant enabler in the pursuit of disruptive innovation. It is believed that flexibility in cost structures and targets will allow managers to support emergent approaches and opportunities, which Christensen (1997) and Christensen and Raynor (2003) claim facilitates the surfacing of viable disruptive strategies during product development and early phase exploitation. Tools such as technology roadmapping can be used to communicate support for sustaining and disruptive innovation (Phaal et al., 2004) and can therefore be used to also communicate flexible cost structures and targets.

4.3.5.3 Seed funding capital that can be patient for growth.

> *Evidence: "... the only way, in my mind, to deliver a breakthrough innovation without breaking the bank is to treat it as good venture capitalists would do: feed it with a little bit of money at the beginning and then let it prove itself. And this does not mean let it spend without showing results – make it self-sustaining as early as possible and gradually increase funds as its ready for a wider audience." [TH-Senior Consultant-IS-988]*

Leifer et al. (2000) and Rice et al (2002) found as the breakthrough innovation process gathers pace, more is understood about the new technologies, customer offerings and the market places to which they apply. And the organisations that most effectively deliver these breakthrough projects were the ones who typically delivered investment in stages. Rather than committing resources in

one block for the entire development path, resources were allocated along the organisation's development process and throughout staged exploitation. More resources would be allocated when a return on investment could be shown. The benefits and practices of staged funding approaches have been published by Cooper (1983), Block and MacMillan (1985), Stevenson and Gumpert (1985), and O'Connor and Rice (2001). Likewise, it became the belief of the research group that innovation strategy could facilitate the pursuit of disruptive innovation when it supports a manager's decision to provide seed funding. They also came to believe that seed funding capital for potentially disruptive concepts must meet one condition: concept owners must be patient for growth, whilst impatiently seeking profit – although there was serious debate as to whether any of the cases could actually embrace such a practice. Thus, it would seem if a concept is innovative, if management believe a disruptive position can be found, if it can quickly make money and become self sustaining, then the organisation's management team should invest seed funding under the premise of 'impatient for profitability - patient for growth'. In a similar vein many authors are calling for CEOs and other executives to test or adopt venture capitalist approaches to their organisations' investments (Christensen, 1997; Hamel, 2000; Moore, 1995; Gilbert and Bower, 2002; Hellmann, 2000). This could encourage more emphasis on radical project initiation but has not yet translated to practice in industry (Hellmann, 2000) – often with executives worried about the performance of their own stock options and personal benefits (Christensen, 1997).

INHIBITORS:

4.3.5.4 The continuous pursuit of clearly defined, rationalistic planning.

> *Evidence: "My problem with our R&D is that there are central committees planning out innovation strategies and awarding resources to projects that build on past success in a clear and measurable way, almost in an atmosphere of fearing real change, fearing the unknown. People don't like to step out of line. There's no way I could get resources if I didn't know exactly what I was going to deliver." [B-Senior Engineer-IS-120]*
>
> *"... we all [the research group] understand success in our main markets is based upon clear, well planned strategy and responding to our core-customers' needs... but it's this approach that's created a demand in our businesses for all new ideas to quickly contribute to the bottom-line... so we're all guilty of rejecting these ideas that require these evolving approaches... we find them difficult to justify – they're just not simple, they cannot be rationalised in the same way" [D-Divisional Head-Exp-2443]*

The executive management of all four cases exerted pressure for rationalistic long-term strategies – it was found this inhibits potentially disruptive innovations. The pursuit of rationalistic or deliberate planning constrained innovation stakeholders to exploring familiar territories that could be quickly understood. Product management teams were prevented from following emergent demands for their potentially disruptive innovations, because at the outset they were sure they had already

discovered the 'best' strategies. McGrath and Macmillan (1995) explain that a lack of strategic support for discovery-driven approaches, which are difficult to plan in the traditional rationalistic sense, can inhibit the pursuit of discontinuous innovations. Other literature also shows that management practitioners should not allow their responsiveness to be inhibited as true viable strategies materialises (e.g. Kaplan, 1999; Kassicieh et al, 2002). Inweb and Voxar are examples of two of Britain's fastest growing unquoted technology companies, which demonstrate the importance of an emergent approach to strategy (Brennan, 2003b). Inweb - initially a web-page designer – responded to emergent customer demands and is now a telecommunications software provider. Likewise "Voxar had planned to sell its imaging software to computer games designers, but when this failed the company adapted its software... Today, Voxar's [disruptive] technology enables doctors to take output from medical scanners and turn it into three-dimensional images displayed on a standard personal computer, rather than an expensive purpose built work station (Brennan, 2003b:4). It is believed by the participants of the research that managers must redress the weighting they give to rationalistic strategy and remember the benefits of more emergent approaches.

4.3.5.5 A drive to become big, fast.

Evidence:

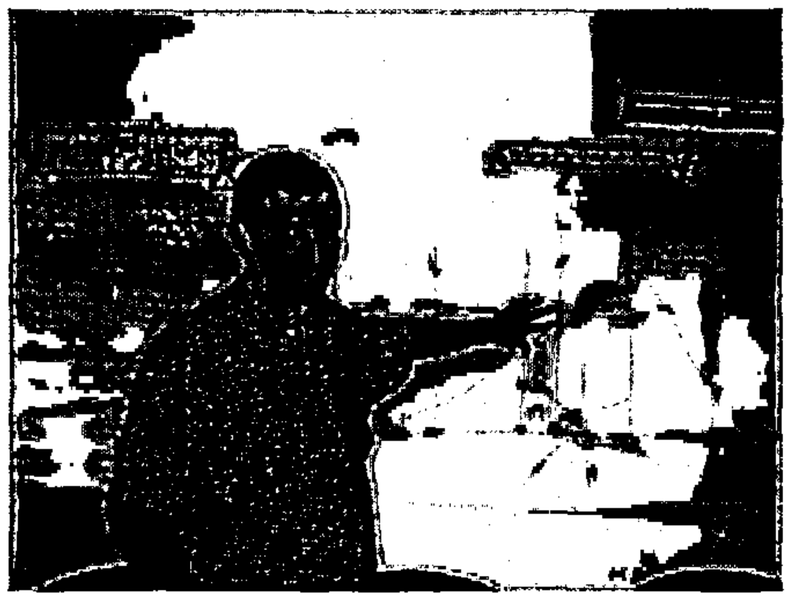


Figure 4-6:

Case B's drive to become big, fast.

Using a large scale graphic of Moore's (1995) adapted 'technology adoption life cycle', one of Case B's senior engineers is enabled to show the research group how his firm "... always focuses attention to target big markets with sophisticate products. We don't like to spend time in small markets – they don't generate enough revenue." (Figure 4-13) [B-Senior Engineer-IS-1950]

Executive level management from cases A, B and D (and strategy advisors from case C) gave evidence to show how pressures for growth created a corporate strategy that drives all new concepts to become very big, very fast. This compelled managers to force potentially disruptive technologies and offerings into sustaining roles in established markets – especially familiar

territories. Such strategic pressure was found to be a key motivator behind the decision to compete in large markets, against established market players and prevailing customer priorities and preferences. Consequently, managers attempting to pursue disruptive innovation within these organisations would be driven, consciously or unconsciously, to pursue mass investment and ultimately fated to either manage high-risk projects or to oversee concept failure. Hipple, Thomke and Sonnack (1999) credit 3M's success to avoiding the temptation of mass markets, instead when they discover a breakthrough technology or offering, they conduct a true lead-user analysis to identify niches of customers who would benefit from the concept. Moore (1995, 1998, 2000, 2002) provides overwhelming evidence to suggest a premature move to the mainstream will change what could be a disruptive innovation into a failed invention. His examples include the DVORAK keyboard, the Sinclair C5, and Microsoft's and Newton's attempts at replacing the keyboard with hand writing recognition devices.

4.3.5.6 Restrictive models of innovation.

> *Evidence: "Quite often, we've found, the people with the 'purse strings' are not very literate with new developments or approaches in the wider domain... they have a picture in their head of what innovation should look like; this is why our unusual [radical and potentially disruptive] ideas do not get funded." [C-Senior Manager-IS-816]*
>
> *"I've spent many years now in this rather conventional industry and I've always found that there's a kind of narrowness of vision, a kind of fear of exploring anything that goes beyond these, [participant lets out a big sigh] these self imposed limits of what is or isn't permitted" [C-Strategy Advisor-IS-1004]*

Even when there is a strategic intent to pursue radical or disruptive innovation, the expert interviewees and case study participants spoke of how restrictive 'views' often inhibit strategic action. They initially stated that these views consisted of restrictive images of their own organisations and constrained acceptance of what innovation is. This notion is supported by Morgan (1993, Figure 4-7). Deeper analysis revealed that these restrictive views took a number of forms. In one of its worse guises, the executive management team maintains a 'we are our products' standpoint – as opposed to the view propagated by Prahalad and Hamel (1990) that asserts 'we are our competencies'. This inhibitor was most prevalent in cases A and C; case B was making efforts to break away from such a restrictive view point and case D reported nearly all of their clients suffered with this disabling assumption. Dougherty and Hardy's (1996) investigations, of the organisational tendency to allow prevailing core activities to drain support away from truly innovative ideas, illustrates that the access to resources can often be inhibited by the firms perception of the importance of innovation. "An organization with both innovation projects and

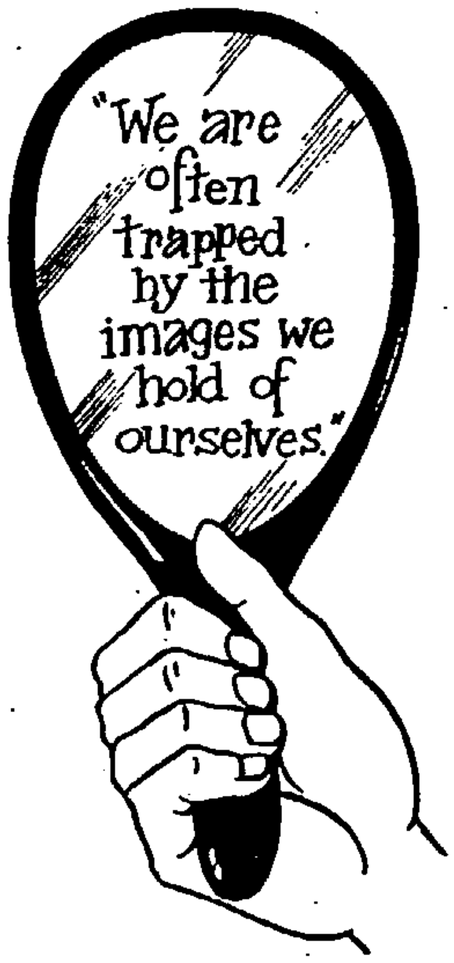


Figure 4-7: Restrictive models of innovation. (Morgan 1993:xvii)

mature businesses ideally will have a resource system that channels money, equipment, experience, and information to all these activities simultaneously... Unfortunately, resources do not always flow smoothly to innovation, particularly where prevailing practice supports established activities." (Dougherty and Hardy, 1996:1122). It would seem that average performing organisations constrain innovation to exclusively focus upon continued improvement of prevailing, familiar or mature business opportunities. Therefore, this investigation provides evidence to support Tripsas and Gavetti (2000), Chandy and Tellis (2000) and Ahuja and Lampert (2001). It shows that executive management teams with a restricted view of innovation can fail to allocate and protect resources for potentially disruptive innovations.

As will be shown in the proceeding chapter, this inhibitor proved to underpin the most critical barriers to disruptive innovation.

4.3.6 Human Research Management:

DESCRIPTION: The capability to select, hire and/or nurture managers for new-growth, potentially disruptive businesses, whilst maintaining the selection, hiring and training of managers for sustaining current core activities.

ENABLERS:

4.3.6.1 Diffuse knowledge on disruptive innovation throughout the organisation.

> *Evidence: "Its my opinion that innovation is a key building block of competitive advantage; therefore, executive managers must take responsibility for incorporating cutting edge understanding of innovation processes into their business. The philosophy of my team was that we could facilitate the technology divisions in commercialising their breakthrough inventions via the delivery of internal educational on the innovation process. This was and still is an essential ingredient. [KF- Commercialisation Director-HRM-628]*

Kaplan's (1999) work with Hewlett Packard produced implications for the human resource management issues in discontinuous and disruptive innovation. He concludes that to create an environment conducive to discontinuous innovation, leadership must first "internalise and then communicate the qualitative differences between conventional analytical strategy formulation [sustaining innovations] and the search for breakthroughs" (p20). Authors such as Hamel (2000), Rice at al (2002) and Wheelwright and Clark (1992) support this notion of communication, as does

the evidence gathered during this research. The evidence shows that executive and senior management teams, well versed in the theory of disruptive innovation, proclaim they are more likely to support the identification and pursuit of potentially disruptive initiatives. The data also indicates this pursuit can be further enhanced by diffusing knowledge on disruptive innovation throughout the organisation - beyond those responsible for formal resource allocation - and embedding the knowledge into every-day prioritisation mechanisms. There was debate amongst the practitioners about whether or not terminology was important for such knowledge diffusion exercises (e.g. many participants preferred the term 'highly radical' as it felt less destructive than the term 'disruptive'). However, there was consensus on the belief in the importance of diffusing knowledge on disruptive innovation throughout the organisation. It was said that the provision of training and the communication of strategic intent with success stories, could help every mind in the organisation to be aligned to the pursuit of both sustaining and disruptive innovations.

4.3.6.2 Select or hire the right management team.

> *Evidence: "Getting the right management team together was vital... we found out the hard way. A management team that has been successfully delivering incremental innovation on a core product will not be the one to bring a disruptive new concept to the market - they don't have the right experience... applying the same skills that have delivered past successes will kill the disruptive potential of new concepts, stone dead." [RiM-Director of Technology-HRM-821]*

It is commonly stated that the most effective management team for the development and exploitation of new products, services or business concepts will be a multi-functional assembly of experience personnel (Rothwell, 1995; Trott, 1998; Tidd et al 1997, Utterback 1994). Christensen (1997) notes that a team wishing to develop and exploit a potentially disruptive innovation will, taken together, have executive expertise and experience of marketing, sales, technology management and new product development. The data analysis has uncovered six common ideal characteristics for a team pursuing a potentially disruptive innovation: (1) Extensive experience and knowledge of the industries wider domain, 2) 'Start-up scar tissue' - those with experience of starting new potentially high-growth businesses, (3) Experience of being the small player in highly competitive markets, (4) Experience of coping with massive shifts in strategy and product lines. (5) Leadership experience of recruiting, training and retaining new employees in growing businesses, (6) Finally, the team will need members who have confronted similar problems particular to the circumstances of the potentially disruptive innovation. These characteristics are similar to those identified as requirements for the ideal 'start-up' team by Adams (2002), the venture capitalist expert, and other venture capital organisations (e.g. ET Capital -www.etcapital.com and Mobius Venture Capital - www.mobiusvc.com). Furthermore, these characteristics support calls for an

overhaul of recruitment techniques, moving from attribute to circumstance based selection – where organisations will focus upon the experiences they need employees to have had in order to deliver current goals (McCall's 1998).

4.3.6.3 Train employees to build a network of influence.

> *Evidence: "... it shouldn't matter who has generated and built one of these [potentially disruptive] opportunities, what should matter is whether it is valid and worth pursuing. But in reality it does matter. You've got to be able to convince your expert colleagues for a theory or a claim or an observation to be taken seriously... So we're left in a difficult position, although we want to pursue these [potentially disruptive] opportunities it matters a great deal who puts an idea on the table... People with these [potentially disruptive] ideas in the past have built a community of interest before they try to access a manager with respect or weighting at the executive level. We need to give our engineers space to do this like we used to, this way it becomes hard to stifle great opportunities too early." [B-Senior Programme manager-HRM-191]*
>
> *"Say 'revolutionary innovation' and people think of romantic stories of the lone genius who fights against the odds. I can tell you innovation cannot work this way. Innovation is hard work... A lone innovator cannot do this - innovation is about collective hard work and action." [D-Divisional Head-HRM-1593]*

O'Connor and Rice (2001) found that the capacity of an organisation to recognise disruptive opportunities is directly related to the continuity of informal networks of individuals engaged in the conversion of breakthrough insights into new ventures. "Upward networks (access to senior managers) provide protection and access to pockets of money, while the broad-based lateral and downward networks appear to provide information, confirmation of the recogniser's perception of the opportunity, and other resources" (O'Connor and Rice, 2001:107). Rice et al (2002) highlight that networks are a cost effective and efficient way of supporting innovation; they are often based upon personal friendships, histories and favours. These authors also suggest that organisations could be missing opportunities to help people think and act creatively if they are not leveraging the use of internal and external networks or they are in industries with a high staff turnover. Analysis of the expert interview data corroborated the importance of networks of influence. It was found that to acquire resources, for a potentially disruptive or highly radical innovation, a manager needs influence within their organisation, and to gain influence a manager needs a supporting community of interest that contains senior executives. The importance of network effects is discussed at length by Dawson (2003) and Rosen (2002). This was observed to be an often overlooked issue within the case study organisations. Therefore, following discussion, it was believed by the participants that opportunity recognisers, who are trained to acknowledge the importance of a community of interest, will cease to overlook the qualitative issues of the people involved in their initiative. They will be encouraged to build a network of influence alongside a significant

quantitative assessment of market validation information. The worlds leading innovators use these approaches. Sakkab (2002) demonstrates that Procter and Gamble have adopted the use of communities of interest to develop new business opportunities and that the mobilisation of a community of practice is a key means by which to manage the introduction of a discontinuous new product offering. Likewise, Swan et al. (2002) demonstrate that new communities of practice are an essential factor in the introduction of radical technologies.

INHIBITORS:

4.3.6.4 The wrong kind of project manager with the wrong kind of values.

> *Evidence: "...on a number of occasions I've seen people present concepts with, what you might call, disruptive potential, only to watch very senior people passionately attack the ideas, and in some cases the presenter as well. These attacks always get post-rationalised and justified, but to me, they're completely irrational, based on an extraordinarily narrow view of what [Case C] is, and what it should be doing. We need management with different values..." [C-Strategy Advisor-HRM-1005]*
>
> *"I can tell you, none of my team would be able to deliver a new type of product in a newly established market, they're used to projects that involve helmets [Case A's core product], they just don't have the have the right experience..." [A- Director General-HRM-1631]*

The data set and the literature (Christensen and Raynor, 2003; McCall, 1998) demonstrate that the most important resource a development project can have is that of experienced management with supporting values - when developing or exploiting a potentially disruptive innovation this is no less true. However, the data set and the literature (Allen et al, 1999, Christensen, 1997; Christensen and Raynor 2003) find that trusted managers with proven track records in delivering sustaining innovations are likely to be the wrong kind of managers with the wrong kind of values when pursuing disruption. Most participants believed that managers trusted for traditional business activities will not have the appropriate pool of experience to draw upon (e.g. starting new-growth businesses) and their values will be entrenched in the model of sustaining innovation (e.g. targeting existing markets and fighting the prevailing competition).

4.3.6.5 Performance metrics linked to optimisation and not innovation.

> *Evidence: "In new small organisations people have freedom in putting forward ideas. They don't have to deal with all the problems of innovating that we do. In big companies like ours, you just don't get this freedom because of performance measures. Young management trainees are dependant on short term success in their projects and want to impress their supervisors. This makes them conservative and very afraid to challenge norms. Then supervisors and senior managers, like me, are dependent upon people higher up in the business approving their work and saying 'you're the right man for the job' - so we don't make waves either. All this makes everyone frightened of challenging conventions." [B-Senior Engineer-HRM-1269]*

Following their investigations of strategy making and strategy implementation, Noda and Bower (1996) emphasised the critical importance of the achievement of operational results against set targets. They found positive operational results increased middle managers support of initiatives and the credibility of those involved, whilst negative results delivered indecisiveness and a loss of credibility. Thus, the performance metrics, by which managers are measured, must be supportive of the pursuit of disruptive innovation, however it would appear that top management rarely make these sorts of considerations. The management development systems within cases A, B and C, like many in the world, moved high-potential employees around their businesses using placements - aiming to provide a broad experience of the different business areas. Despite its benefits, this approach focused intelligent employees on the delivery of short-term business benefits. This is believed not to be conducive to the pursuit of disruptive innovation (Charitou and Markides, 2003; Ahuja and Lampert, 2001; Amabile, 1998). Performance metrics in cases A, B and C were linked to optimisation (cost cutting, lead-time improvement etc); once again focusing managers on the delivery of business benefits that are not supportive of disruptive innovation. Furthermore, as incentive and compensation schemes were not linked to innovation, employees - especially those of the sales force – were prevented from prioritising new customers or new markets. Kaplan (1999) concludes that to create an environment conducive to discontinuous innovation a change is needed within traditional reward systems. He believes that "... because [disruptive] innovation usually represents something new for the organisation, trial and error are almost always necessary... reward systems must... include the acceptance of failure." (p21). Unsworth (2001) and Amabile (1997, 1998) demonstrate that intrinsic motivation and implicit rewards can be used to spur the necessary creative and even breakthrough problem solving. Whereas McFadzean (1998, 2000) introduces specific techniques to enhance creative thinking, it is believed that the use of such approaches could be linked to reward systems.

4.3.6.6 Employing managers that fit the mould.

Evidence: "In my opinion, what makes a true radical innovator is a person who can set aside societal norms. At the very least, they have to be ready to not accept the status-quo as they have to want to change it, if they are going to innovate. This tendency, I think, is often found in eccentric people... these sort of people don't feel bound by the structures of how things usually get done but sadly, many of these unconventional types don't speak the same language as our executive management. We need to make sure we employ more people like this and then train them to have better communication skills because, right now, we end up ignoring them." [C-CEO of Case C Spinout-HRM-1001]

Following their investigations of strategy making and strategy implementation, Noda and Bower (1996) emphasised the critical importance of the achievement of operational results against set targets. They found positive operational results increased middle managers support of initiatives and the credibility of those involved, whilst negative results delivered indecisiveness and a loss of credibility. Thus, the performance metrics, by which managers are measured, must be supportive of the pursuit of disruptive innovation, however it would appear that top management rarely make these sorts of considerations. The management development systems within cases A, B and C, like many in the world, moved high-potential employees around their businesses using placements - aiming to provide a broad experience of the different business areas. Despite its benefits, this approach focused intelligent employees on the delivery of short-term business benefits. This is believed not to be conducive to the pursuit of disruptive innovation (Charitou and Markides, 2003; Ahuja and Lampert, 2001; Amabile, 1998). Performance metrics in cases A, B and C were linked to optimisation (cost cutting, lead-time improvement etc); once again focusing managers on the delivery of business benefits that are not supportive of disruptive innovation. Furthermore, as incentive and compensation schemes were not linked to innovation, employees - especially those of the sales force – were prevented from prioritising new customers or new markets. Kaplan (1999) concludes that to create an environment conducive to discontinuous innovation a change is needed within traditional reward systems. He believes that "... because [disruptive] innovation usually represents something new for the organisation, trial and error are almost always necessary... reward systems must... include the acceptance of failure." (p21). Unsworth (2001) and Amabile (1997, 1998) demonstrate that intrinsic motivation and implicit rewards can be used to spur the necessary creative and even breakthrough problem solving. Whereas McFadzean (1998, 2000) introduces specific techniques to enhance creative thinking, it is believed that the use of such approaches could be linked to reward systems.

4.3.6.6 Employing managers that fit the mould.

Evidence: "In my opinion, what makes a true radical innovator is a person who can set aside societal norms. At the very least, they have to be ready to not accept the status-quo as they have to want to change it, if they are going to innovate. This tendency, I think, is often found in eccentric people... these sort of people don't feel bound by the structures of how things usually get done but sadly, many of these unconventional types don't speak the same language as our executive management. We need to make sure we employ more people like this and then train them to have better communication skills because, right now, we end up ignoring them." [C-CEO of Case C Spinout-HRM-1001]

When considering consumers' likeliness to buy a new customer offering, Moore (1995) makes a distinction between the early-market technology adopters and the change resistant majority. He states that these differences can also be seen between employees who bring disruptive breakthroughs to fruition – the visionaries - and those that drive long term profits in established markets – the pragmatists (Table 4-2).

Visionaries	Pragmatists
- Intuitive	- Analytic
- Support revolution	- Support evolution
- Contrarian	- Conform
- Break away from the pack	- Stay with the herd
- Follow own dictates	- Consult with colleagues
- Take risks	- Risk averse – manage risks
- Motivated by future opportunities	- Motivated by current problems
- Seek what is possible	- Pursue what is possible

Table 4-2: The differences between visionaries and pragmatists (Moore, 1995)

A key difference was observed between the human resource management practices of the cases and the expert interviewees' organisations: specifically, how they spoke about their recruitment of managers. Organisations need pragmatists to maintain current business activities and visionaries to break new ground and must therefore recruit accordingly (Hamel, 2000). However, the cases had a track record of employing management in the mould of their existing teams, which consisted almost entirely of pragmatists. Instead, the expert interviewees claimed their organisations enjoyed a mix of people and personalities - both visionaries and pragmatists - which they claimed prevented group-think and increased the chances of bringing novelty to the organisation. The benefits of this approach are reported by Amabile (1998). It was also stated by many of the case study participants that people who do not ask 'why?' do not inspire revolutionary thinking, this belief is also supported by McFadzean's (1998) data, yet recruitment within the cases did not match this insight.

4.3.7 Organisational Ecology:

DESCRIPTION: The capability to manage the organisational ecology - defined by an expert within the research group (Dvir, Roth, Pasher, 2001) as the physical infrastructure and the culture of the business - to support both continued business improvement and the pursuit of disruptive innovation.

ENABLERS:

4.3.7.1 Cultural support for disruptive innovation whilst the organisation is growing.

> *Evidence: "A good salesman is closing his next deal whilst serving his current client. It's similar at [TH's company], we have a culture ingrained into us - whilst we're generating revenues from our core technologies we're investing into what we hope will be the next disruptive technologies in the ICT [information and communication technologies] sector... You see, you can't leave it too late, our innovative culture won't let us; to invest late in these novel concepts will put, how do you say, too much pressure on them to make money too quickly - you see, they need to be protected from corporate growth targets when they're immature..." [TH-Senior Consultant-OE-2113]*
>
> *"It's clear to us now; we needed to invest in disruptive innovation when our business was healthy. It would have been a lot easier to grow our ideas and disruptive projects before we hit these hard times... [However] it would not have been easy because our organisation is buried in a culture of helmets [Case A's core customer offering]. [A-Director General-OE-723]*

Hamel (2000) notes "Sooner or later, every business model reaches the point of diminishing returns. And these days, it is more often sooner than later" (p53). Utterback (1994) and Tushman and O'Reilly (1997, 2002) shed light onto this dynamic, they demonstrate how technologies and products emerge, grow, mature and decline in patterns that are referred to as "S-Curves". These authors and many others, including Christensen (1997), Day et al (2000) and Nelson and Winter (1982), have studied this phenomenon at great length. One of the conclusions of such work is that executive management teams, which have organisational survival as a priority, should invest resources into developing in new technological or product S-Curves when their core technologies/products are in their growth phase. This will allow the new technologies or products to emerge whilst their existing alternatives move into their maturity phase. However, Rice et al (2001) found that if a team has managed to foster a potentially disruptive idea, it often faces problems getting internal support. Quite often this was a cultural issue, where employees felt attached to core technologies, customers or the past. Thus it is essential that an organisational culture - its values, support systems and ethos (Barney, 1986) - encourages the investment of resources into potentially disruptive innovations whilst the organisation is growing. All the participants of the research believed that such cultural support would allow executive management teams to shield disruptive opportunities from the corporate growth demands. This would provide them with a nurturing environment before rapid insurgence into mainstream markets. Furthermore, they felt that such a culture would dissuade management teams from allocating resources to products where there are clearly diminishing returns on investments – freeing resources for other

investment opportunities. Kaplan (1999) summarises "When the organisation views success as transient, and long term growth as contingent on creating the next S-Curve, discontinuous [and disruptive] innovation becomes a collective imperative." (p21).

4.3.7.2 Maintaining tension between stability and chaos.

> *Evidence: "... you have to add a little spice to the workplace if you want to encourage people to create and pursue these [potentially disruptive] ideas. You have to try things out, make a fool of your self, I mean, I make a point of making a fool of my self daily, because without making a fool of your self, without falling on your arse, you simply do not have successes - you do not have success, you can not have success, without failures in the world of innovation... a little chaos is a great source of stimulus – to support all this we have a joker card system... I tell friends that it's actually an 'I've f**ked-up system'. Everyone has three joker cards that they can play at anytime throughout the year. It's a way to encourage bravery... you can f*ck-up big-style three times in a year and it simply does not matter. This way people feel protected if they are going to follow a crazy idea or try a new radical approach - if it fails, you can play one of these joker cards to your bosses, and you've had a great learning experience that can be shared with the business. ... ok it has to be monitored, but I insist that everyone uses their joker cards, if they don't, I want to know why." [RuM-Director of Innovation-OE-2300]*

Authors, such as Ahuja and Lampert (2001) and O'Connor and Rice (2001), state that the recognition of breakthrough and discontinuous opportunities is a creative act. They and authors such as Kelley and Littman (2001) also show how the innovation process for radical and unusual ideas consists of a series of highly creative problem solving steps. Zhou and George (2001) find that job dissatisfaction can lead to creativity when employees are encouraged to express their opinions. These "expressions of voice" (p682) can be seen as stimulating a little tension in an otherwise stable working environment. Likewise, McFadzean's (1998, 2000) research shows that groups, wishing to generate highly creative or even breakthrough ideas, have to foster an environment where they are free to break prevailing paradigms - she finds this is difficult to achieve in normal stable working conditions. Amabile and Gryskiewicz (1989) developed an inventory of the workplace that could assess capacity for creativity and creative problem solving. Their findings suggest that a stable environment is not conducive to the creative output needed for breakthrough insights. Yet, Amabile (1998) finds heavily chaotic working conditions to be prohibitive of creativity. Thus a tension needs to be found between stability and chaos – a notion also promoted by Brown and Duguid (2001). The data contains evidence from the expert interviewees that shows how management teams purposely introduce a little organised chaos to their working environments. These people appear to take responsibility for delivering an organisational ecology that has a high-tolerance for first-time mistakes – exonerating them as essential learning opportunities - and for people who challenge entrenched norms. Furthermore, practitioners from all four cases recounted stories when tension, turbulence or a little chaos

generated radical ideas and, in hindsight, potentially disruptive propositions. It would seem that a culture that maintains tension between stability and chaos appears to provide fuel for rule busting innovation.

4.3.7.3 Proactive manipulation of the physical working environment.

> *Evidence: "... if you ask the top man of our office, Colin, what his main job is... ordinarily he'd say that his main job is managing the culture and physical layout of the office and he takes this very seriously... you can't expect people to do good stuff in a 'shitty' place [MB-Head of Ergonomics-OE-2149] ...for example, the entire third floor is what I like to call our 'Project Village', you can put up all kinds of visual stuff... you can have all your information surrounding you all of the time... to get more inspiration or more challenges... the floor is open for use and accessible by everybody. Other people, not in your project team, can walk past and see the sort of stuff that you're doing and... you get a really good kind of cross-fertilisation." [MB-Head of Ergonomics-OE-2151]*
>
> *"... we've successfully tested co-locating - temporarily and permanently – these groups notorious for poor understanding of each others lead times and roles. This has delivered dramatic effects, especially when they were looking at breakthrough concepts. Their perception of transaction costs is now much more realistic, information flows are stronger and our innovative capacity has increased". [KF-Commercialisation Director-OE-791]*

The notion that the physical working environment plays a part in the productivity of employees is not new, however, it is less prevalent in the field of innovation. Allen (1977) provides insights into how the manipulation of the physical workplace can facilitate the flow of knowledge and technology development. Kelley and Littman (2001) are huge advocates of providing working environments that are conducive to creating problem solving and radical idea generation. They believe very much in allowing people to manipulate their own workplace for the benefit of their business objectives. The data analysis also revealed that a management team's active manipulation of the physical working environment can enable and support the pursuit of disruptive innovation. For example, it was found that the arrangement of the physical environment to encourage cross-fertilisation of people, communication and ideas, can reduce functional boundaries to early idea generation and project development. It was believed that this is essential to the early phases of disruptive innovation. However, such an environment was suggested as unsuitable for project delivery – where group members need 'quiet time' to concentrate. Thus, the participants also stated their requirement for the provision of quiet, secluded or private spaces, which can be appropriately manipulated by individual project teams. Such an environment would increase focused attention during delivery phases and assist teams in rapid experimentation or implementation. Evidence of these environments was either seen or spoken of with the experts and two of the four cases had started experiments with their physical workspaces. It is believed that

involvement of the workforce in the manipulation of the physical environment is important and preferable; however prevailing fiefdoms should not be allowed to selfishly dictate changes.

INHIBITORS:

4.3.7.4 Failure to recognise the importance of culture and values.

Evidence: "The whole innovation thing in this firm is about me standing up and saying come on folks we really ought to innovate, and then creating an 'innovation culture' by providing the training, the conditions, the support and the motivation. I'll keep encouraging and helping, encouraging and helping, and encouraging and helping, until everyone is capable of delivering simple step change and radical breakthroughs... buts it's taken serious senior support. Before I arrived the top chaps didn't really consider the processes that create a culture of creativity that values innovation. People spoke of a system - that kind of existed in the shadows - which made everyone conform to familiar territories – scared of pushing the envelope." [RuM-Director of Innovation-OE-2082]

"If we want to generate some urgency about pursuing disruptive innovation throughout the whole business, we'll have to manage our innovation processes and funding differently, as these are the factors that drive our company's culture... we need to deliberately put grit into the oyster. Perhaps we need to break down the perceived stability of our organisation but this is a messy business - perhaps that's why we avoid it." [C-Strategy Advisor-OE-1748]

The data showed that many statements of intended strategy, such as those to pursue radical and disruptive innovation, become undermined by the diffused, invisible daily decisions made by employees to prioritise one activity over another. This notion is also supported by Mintzberg et al (1998) and Stacey (2000). These decisions ultimately underpin the emergence of strategic action and it was found by this research that they are more likely to be governed by culture than intended vocalised strategy. Cases A, B and C displayed little effort to contend with the anti-disruptive innovation 'shadow systems' (McMillan 2004) that were at play within their businesses. Consequently, it was found strategic intent is more likely to govern decisions in the upper echelons of the organisation, yet organisational culture and values dominate employees' daily prioritisation decisions. Thus, the failure to recognise the importance of culture and values and the failure to influence these factors, was found to be a major inhibitor to the pursuit of disruptive innovation. Barney (1986) provides a more detailed discussion on culture as a source of competitive advantage and Stacey (2000) provides a detailed account of the shadow systems that can impact strategy execution.

4.3.7.5 An 'accident and emergency' organisational ecology.

Evidence: "We're facing hard times; if we come up with an idea we don't have time to waste, we have to make up our minds quickly... Everyone knows to ask 'Does it add value to our main customers?' 'Is it low cost to us?' If the answers are 'yes' then we begin to invest our time." [A-Director General-OE-59]

"We're a global organisation that's feeling the pain of competition, sure, we're motivated to pursue innovation but right now its real tough... my concern is that our teams in the field feel that in our current climate there is no place to nurture or grow ideas – right now we too quickly ignore or kill suggestions" [C-Senior Manager-OE-163]

Allen et al (1999) state that the ecologies of most organisations can be paralleled to front-line hospital 'accident and emergency' departments. They reward the ability to conduct 'rapid fire' analyses of situations, where judgements need to be made quickly, along with prompt action. Each case study involved in this research displayed an organisational ecology which rewarded quick decision making, fast formation of assumptions and insistence upon quick action. This was contrary to reports from five of the seven expert interviewees'; in their businesses, employees can find support for suspending judgement, building empathy for new ideas and nurturing potentially disruptive concepts. Oldham and Cummings (1996) suggest that the 'accident and emergency' business culture of the case organisations will hamper creativity and contribute to a reduced numbers of out-of-the-box ideas. Andriopoulos (2001) also shows that these ecologies either quickly kill potentially disruptive ideas or do not even allow them to surface. Furthermore, the participants reported they often felt emotionally withdrawn and therefore frustrated because of their 'fast to judge' business environments. Despite claims by Zhou and George (2001) that job dissatisfaction can lead to creativity, the impact of these sort of emotions is damaging to an organisations ability to innovate in general (Lofy, 1998).

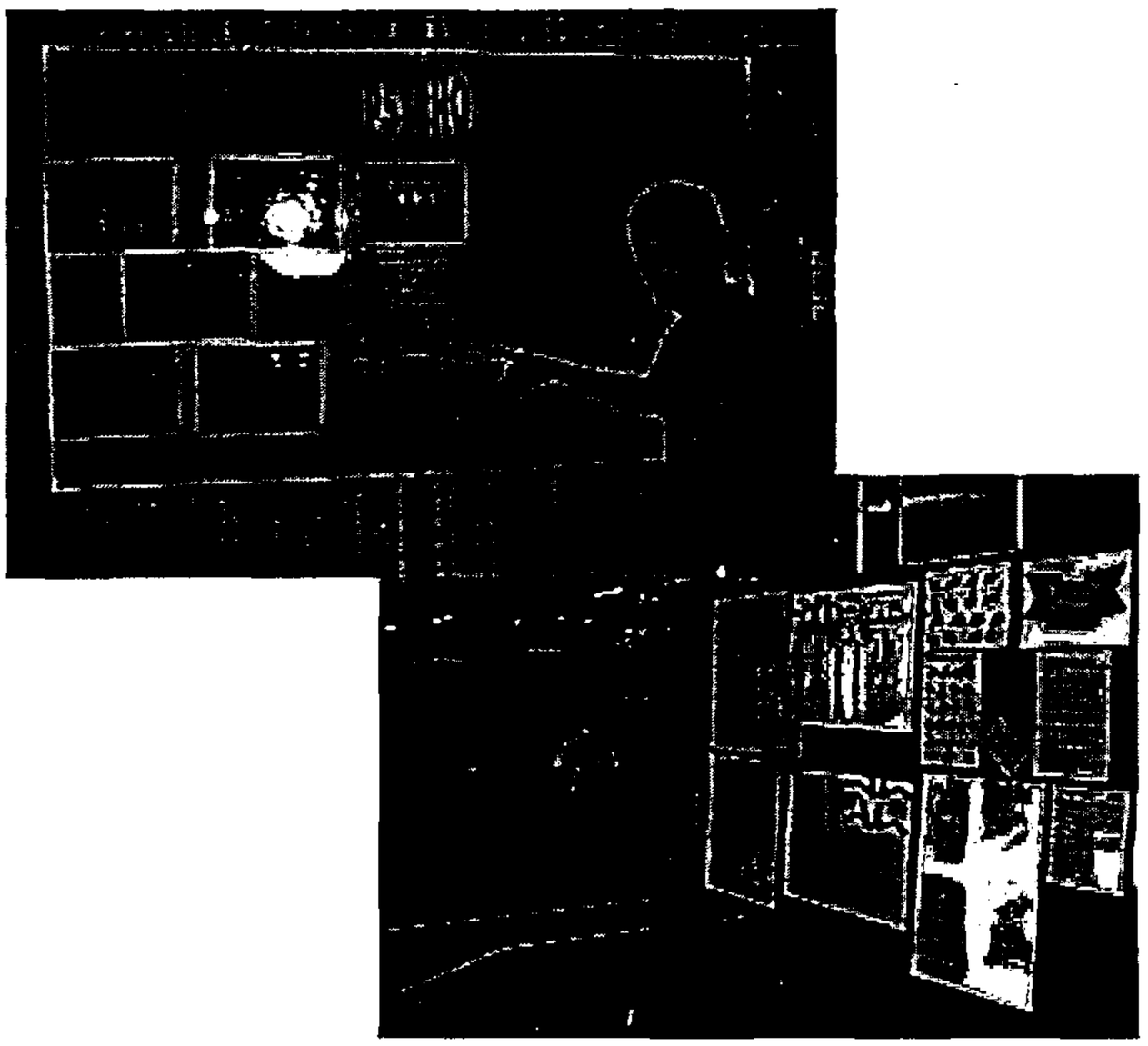
4.3.7.6 Physical working environments dominated by legacies from the past.

Evidence: "... we say we want to have radical innovations and we say we want to go into new markets but we don't look at our offices or the factory and think about how we can change the way they look, the way they're laid out... I mean, we have photos and posters everywhere of cycling and cycling teams; we show our bicycle helmets in the reception and the rooms where we have our meetings.... we sit in our offices, separated from each other. How are we going to ever break away from the past?" [A-Head of Sales-OE-1822]

Figures 4-8 and 4-9 below illustrate the participant's grievance with the physical ecology of Case A's offices and factory.

A & B = Displays of protective helmets from the past and present in the main entrance hall and in the reception area of the meeting rooms. There is no showcasing of other product categories.
C = Cycling trophies won by the company's race team behind the reception desk.

Figure 4-8: Examples of Case A's Office Environment.



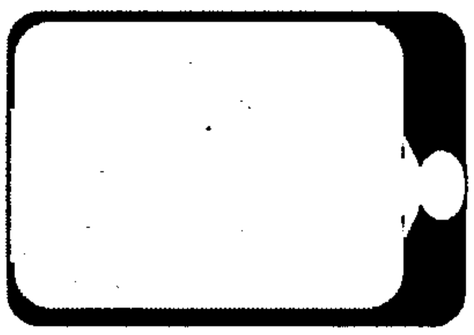
One of three notice boards for capturing and displaying process innovations for the helmet production line. There are no such boards for the production lines of other products.

A notice board on the factory floor displaying new ideas and top priority live innovation projects. The board is dedicated to incremental product innovations of protective helmets despite ventures into new markets.

Figure 4-9: Examples of Case A's Office Environment.

Leonard (1995) and Ahuja and Lampert (2001) are among many authors who provide compelling evidence to show how organisations' core competencies eventually become core rigidities – especially in the face of disruptive innovations. Similarly, the expert interviewees stated that it is essential to celebrate organisational competencies and past success, whilst simultaneously getting ready to both learn and unlearn for the future. Four of the seven expert interviewees linked support for this notion to the necessity of keeping the physical working environment fresh. In this sense they believed the workplace can be used to ensure the workforce is proud of its history but not tied to it. Similarly, senior practitioners from all four cases demonstrated their belief in Leonard's (1995) concerns; however, they allowed their physical working environments to be dominated by artefacts from past glories and current activities with core markets. It is believed that the workforce of the case organisations were, either consciously or subconsciously, being influenced or constrained by these environments. V.Ward (1999), A.Ward (1999) and Salter (2000) all claim that an organisation must carefully manage its physical environment to stimulate a future focus and Kelley and Littman (2001) provide guidance on how to manage this task. Both the evidence and the literature shows that a physical working context will impact the innovation effort, whilst it is important to stimulate pride in past achievements, it would appear that artefacts can also inhibit the acceptance of an important fact: success is transient and long term growth is contingent on finding and exploiting new growth technologies and new customer offerings.

4.3.8 Interaction with the External Environment:



DESCRIPTION: The capability to interact with the external environment, with the necessary breadth and depth, in order to support an innovation process that simultaneously pursues sustaining and potentially disruptive innovations.

ENABLERS:

4.3.8.1 Look towards unfamiliar markets.

Evidence: "... a big part of all this [the pursuit of disruptive and breakthrough innovations], is seeking stimulus, but you are unlikely to come across insights by sitting at your desk... I think that the internet helps these days but, you know, your desk is actually quite a small place. Getting out there in the world and once again encouraging all your key people to get out there in the world, by saying you do not have to work from this desk, go see at first hand what other markets are doing go and look at those people that the products are missing out... Getting people to understand the value of getting unfamiliar stimulus into their working lives is enormously important." [RuM-Director of Innovation-Ext-2298]

"... one of the key ones [facilitators of disruptive innovation] is simply the fact that we go outside the norm, we go into context, we talk to people, people we may have never talked to before, so we get lots of chaotic rich information from that. Another way of facilitating these [breakthrough] ideas is by going to people internally, introducing them to your ideas or to the stimulus that you've gathered from outside, as we all react and respond in different ways... You can also look for 'challengers' or people like that, people - internally or externally - who can challenge the way you think and provide different perspectives on the same problem..." [MB-Head of Ergonomics-Ext-2174]

At the outset of the research the practitioners stated their primary sources of stimulus gathering for opportunity development were market surveys, information from the press, and internet publications. As the relationship of the research group matured and learning was at its peak, it was stated by participants from all four cases that an organisation will struggle to deliver disruptive innovation if it does not look into unfamiliar places. An especially significant source of rich data and information was said to found by speaking to ignored non-consumers, over-looked low-end customers and organisations which offer no competitive threat. The practitioners believed significant opportunities could be generated if approaching these groups with an open mind. Strong support for this insight can be found from Allen et al (1999), Hamel (2000), Kelley and Linton (2001) and Unsworth (2001).

4.3.8.2 Test new relationships with the aim to find new strategic alliances.

Evidence: "... it's a bad analogy but from my experience, an organisation that's seeking to deliver truly radical innovation is rather like a person who needs a breakthrough in an otherwise boring personal life... You've heard the story before, you've reached the point where you no longer get joy from your marriage or a relationship... and you start to look around... flirtations lead to secret love affairs and maybe short-term experiences, you know, a one-night stand here or there, and suddenly, BLAM! You've found your new love interest. Who should take responsibility for this sort of strategic flirting? Top managers. ...we've found that if done properly, the worse case outcome is a learning experience for management and practical testing of their communication channels... The most likely outcome is that your business has collected some really interesting information and contacts, perhaps generated some new insights and even some ideas for the future – at least a better understanding of the wider domain... The best case outcome is the identification of a new strategic partner... the creation of a vehicle, a new marriage if you like, that will help develop and bring excitement and new [potentially disruptive] innovations to market." [SR-Professor-Ext-2258]

Rosenbloom and Christensen (1994) draw attention to the 'value network' in which an organisation is embedded. A value network is "the context within which a firm identifies and responds to customers' needs, solves problems, procures input, reacts to competitors and strives for profit" (Christensen, 1997:31). These networks can involve innumerate partners, suppliers and distributors and play a critical role in how organisations foster or react to disruptive innovation. The data set shows that managers, who want to generate competitive advantage from theory on disruptive

innovation, will need to establish and test new commercial relationships. It would appear from the data that management teams need to move towards strategic dalliances (Phillips et al., 2004) to disrupt or to create new market linkages, or to disrupt or to make obsolete existing competencies. This was also insinuated by Rothaermel's (2001) references to the need for more and varied "inter-firm cooperation to exploit an incumbent's complementary assets" (p687). Data from the case study participants and all but two of the expert interviewees indicate that an organisation is more likely to identify and exploit potentially disruptive innovations if dallying with new suppliers or distributors, with the intended pursuit of radical new wealth creation. The British microchip designer, ARM, is an example of an organisation that has created new knowledge and new wealth through new collaborations. In 1997, it reported its annual revenues had totalled £16.7m; by 2003, its revenues exceeded £125m. The CEO (Warren East) states "ARM wanted to create a global standard and so we had to go international. We soon realised the huge value of new partners and the importance of investors who really understood our market" (Brennan, 2003b:4). Furthermore, both the data and authors such as Inkpen (1996) suggest that individual managers' interpersonal skills and abilities to initiate and develop new relationships are critical to this activity.

4.3.8.3 Mechanisms to monitor developments in the wider organisational domain and external environment.

> *Evidence: "I use what I call 'immersive' tools with executive teams, such as 'Quests', 'Praxieums', and 'Constellations', to help them identify their organisation's uniqueness... Then it really helps if you can help the client to build a rich picture of what's going on in the wider context, their realm if you like... What's happening across the supply chain of their industry? Who are the new players in the periphery? Who are the competitors and the 'complementors'? And you need to build a picture of emerging trends and new government policies that could impact them. From here it's much easier to see how they can better exploit their uniqueness to create a breakthrough in the wider realm. In my opinion, this is the major key to the breakthrough or disruptive innovation process." [TF-Director-Ext-1899]*

Managers from the cases involved in the research came to believe their ability to foster potentially disruptive innovations will be directly related to understanding three variables within the wider external environment. Firstly, understanding the availability and mobility of suitable personnel. Secondly, the exclusivity of their relationships with customers (legally or implicitly) or the potential exclusivity of relationships with potential customers. Thirdly, their countries' industrial policies – policies which may support or impact business activities (i.e. the UK's tax credit system for research and development expenditure (Bell, 2003). These three focus areas are consistent with Chesbrough's (2003) findings; his analysis of new entry companies into the worldwide hard-disk-drive industry also found the availability and understanding of venture capital funds to be

important. The practitioners involved in this investigation also concluded management teams that establish mechanisms to monitor movements and developments in the wider organisational domain will assist efforts to pursue disruptive innovation. This supports Hamel's (2000) notion that monitoring developments of an organisation's industry "... leads to an overly narrow definition of company's potential opportunity horizon" (p 286). Hamel (2000) states if a management team has an understanding of the wealth creation activities of companies in the vertical 'value chain' and those that provide products or services within the broader 'value network' "... there is little chance of being surprised by a disruptive technology" (p286). The participants believed that an understanding of the wider domain would allow them to apply disruptive innovation theory to look for, and possibly advantage from, the next industry sectors that are prime for disruption (those that are oversupplying customer needs or overlooking new emergent technologies and approaches). Moreover, they stated that such an activity would enable them to collected and distribute stimuli throughout their businesses - to inspire key business personnel and stakeholders in the innovation process.

INHIBITORS:

4.3.8.4 Inappropriate reactions to competitors' actions.

Evidence: "To fight the Chinese competition, we've spent the last years investing heavily into improving our helmet manufacturing processes and the performance of our protective helmet range... we've found efficiencies and cut costs annually by 10% for the past four years and our helmets now outstrip all others on the market for their safety features and durability. This has been difficult, it has taken nearly all our effort and it seems that we will lose the fight anyway... and now... I can see that our determination to fight the Chinese has stopped us from testing new avenues, or new ways to make new money." [A-Director General-Ext-2374]

"We've learnt that incremental innovations are critical for protecting revenues, however in the long-term the only way to deliver substantial growth is through disruptive technologies... The problem companies face in my sector [semiconductors and computing] is that things change so fast - its hard to know how to strike the balance... we need to stay ahead of the competition, or at least keep up with them, but we don't let these people dictate our strategy. We know if we react to every move our competitors make then we run the risk of starving new potentially disruptive technologies from essential resources." [FF-CEO-Ext-2109]

"Our company strategy says we want to be a 'world class innovator' we want to be seen as one of the most inventive companies in the world. Instead, we spend our time and resources jumping to competitors moves and fearing... the unknown. To do what you already do better is important but, but when it dominates everything it's very bad" [B-Head of Innovation Team-Ext-1333]

The executive management teams of cases A, B and C (and the clients of case D) reported that competitor's actions, in existing markets, stimulate a significant demand for imitative or reactionary projects. These unexpected sustaining innovations were mostly launched to the detriment of resources for radical and potentially disruptive innovations. This phenomenon is discussed by Hamel (2000) and Utterback (1994) and reactionary strategies are said to be good practice in immature, developing markets. However, the over-acceptance of reactionary initiatives in mature or established markets often ensures that resources for projects considered to be peripheral are hauled to the core business. This is made yet worse when the reacting firm is faced with diminishing returns from investments into incremental improvements of the core business (Grove, 1996). It is believed an organisation will be less inclined to display inappropriate reactions to competitors' actions if the executive management team has internalised and diffused the concept that technologies and products have limited lifecycles. Unlike the average performing cases involved in this research, such organisations will be more inclined to embrace investments into new areas rather than face price wars and low returns on investments in declining markets (Kaplan 1999).

4.3.8.5 Failure to build new communities of interest.

Evidence: "... someone may spot an interesting development that has new breakthrough business potential. So we try and get them to pick up ownership... we ask them to get a community of interest going around that particular area... if one starts to form then we know that there is this strong potential and we're not on our own... it's a great way to facilitate idea generation and to reduce communication barriers. More importantly, this also leads to more cross-fertilisation, some great contacts and the rapid maturing of ideas, opinions and points of view" [MB-Head of Ergonomics-Ext-2158]

"... these communities of interest are really important as breakthrough innovation is inherently risky, no emergence of a community and we let go of the idea – you can't force people to share your vision and you can't take all the risk yourself" [MB-Head of Ergonomics-Ext-2159]

"Disruptive innovation is about hard work, a lot of this work is about persuasion. You have to work hard to find allies – inside and outside. You work hard to show your idea is groundbreaking but can still be delivered by the business. You work hard to secure resources. You work hard to build a team that will share and improve and deliver the vision. And whilst you're doing all this, you work hard to build a group of businesses or a community of people who are interested in what you are doing... without these outside people the idea will never take off" [D- Divisional Head-Ext-1592]

Van de Ven and Garud (1989) state that the maintenance of long-term developmental relationships with suppliers, purchasers and distributors are essential for the delivery of sustaining innovation. However, Van de Ven and Garud (1989) discovered from their investigations into the cochlear implant industry, as did the participants of this research, that the emergence of new social systems appear to be critical to the emergence of new technologies. Thus, traditional communities of

interest can leverage well-known ties for effective sustaining innovation. Yet an over-reliance upon these communities contributes to a restricted focus upon familiar customer offerings and technologies, *and appears* to inhibit of the pursuit of new markets and disruptive innovation. Critical to new communities of interest are people who are prepared to invest in the potentially disruptive innovation - whether the financiers are internal or external the importance of investors who really understand the market cannot be overstated (Brennan, 2003b). Expert interviewees and workshop participants stated that *managers who feel disloyal*, when embarking upon new relationships with different organisations, will not be able to spearhead the pursuit of disruptive innovation. Furthermore, they reported that they need to provide more support for their internal entrepreneurs; senior practitioners from all four cases believed that they had employees with entrepreneurial spirit but they lacked the resources to build supportive *communities of interest*. Van de Ven's (1993) findings illustrate that executive management must consider a community setting if they are to succeed with innovation: "Running in packs means that entrepreneurs coordinate with others as they develop and commercialise their innovation." (p224)

4.3.8.6 Lead-customers with too much influence.

> *Evidence: An email discussion about the influence of the external environment quickly focused upon lead-customers, a Divisional Head at Case D stated that these people have influence because they provide key revenues or resources:*
>
> *"I read somewhere recently that scientists like to see themselves as doing a fearless exploration of the unknown, but because of how they get their funding, they end up conducting fearful explorations of the mostly known. Ha ha ha! Thank god it's not just us with this problem then. We've lost some really interesting projects in the past, the sort that could have been revolutionary, because we've gone for the guaranteed revenue from our main customers– but you can't bite the hand that feeds you, can you?" [D-Divisional Head-Ext-1164]*

It was observed that nearly all the participants involved in this research, from all four cases, made statements about their organisational commitment to being 'customer or lead-user orientated'. However, when assessing their statements using von Hipple's (1986) definition of lead-users, it was clear that each organisation was not what they claimed; instead they seemed to be lead-customer compelled. These are very different propositions. By observing 3M, von Hipple, Thomke and Sonnack (1999) show lead-users are often not current customers. Thus attempts at creating breakthroughs at 3M, based upon a true lead-user orientation, necessitates the organisation to look beyond current customers into new market segments. Thus, smart executive management teams that maintain a dualistic pursuit of sustaining and disruptive innovation can be both efficient in their responses to customer's demands and corporately entrepreneurial in new and low-end market niches. Alternatively, the Cases involved in this study were all too aware that lead-customers pay

their bills. Managers had allowed these customers to exert more influence than they ought to, succumbing to focusing too closely on their most profitable customers and businesses. This suggests that organisation's that fall into the trap of being lead-customer compelled – appropriating lead-customers with too much influence - become disabled in the exploration of new territories and constrained in the nurturing of potentially disruptive innovation.

4.4 Overview of findings in relation to research objectives.

The primary objective of this thesis is to *explore the nature and experience of management practitioners' pursuit of potentially disruptive innovations in average performing (or non-best-practice) businesses.* This first wave of research activities employed a collaborative research programme with four industrial cases. To reduce the potential of 'going native' (Van Maanen, 1988), findings from the data collection and analysis were triangulated with data collected from expert interviews and an extensive literature survey. As shown in chapter three (the research methodology) this first wave of research contributes greatly to the satisfaction of the primary research objective and it also contributes to the first sub-objective (although a contribution was made to theory and practice regarding collaborative research designs, this will be discussed in Chapter 7):

Sub-Objective 1:
To deliver an holistic understanding of the key facilitators and inhibitors faced by management practitioners wanting to enable potentially disruptive innovations within their non-best-in-class organisations. And to convert this knowledge into an holistic processual and systemic conceptual framework, grounded in both data and theory.

The literature review (chapter 2) concludes there is a requirement for an holistic conceptual framework which takes a systems perspective to the pursuit of disruptive innovation in average performing companies. For example, Van de Ven and Drazin (1985) illustrate that innovation should be considered in a systemic manner, where multiple contextual and structural characteristics have to be examined simultaneously to identify their effect upon performance. The literature review also shows that the conceptual framework should be grounded in both a resource-based and process-based view of the organisation. Furthermore, it concludes, from methods used in the extant literature, that the construction of a framework of enablers and inhibitors is a valid

approach to contributing to the understanding of managerial and organisational behaviour in the innovation process (e.g. Penrose's (1959) 'growth inducements' and 'growth restraints', Amabile's (1997, 1998) 'creativity motivators' and 'creativity killers' and Dougherty and Hardy's (1996) factors that induce or overcome the innovation-to-organization problem).

To ensure a systems approach was adopted, data were collected in four main units of analysis: managerial cognition, managerial action, internal organisational context and external organisational context (in accordance with Strauss and Corbin (1990) and Partington (1998)). The data collection and analysis methods used during the first wave of this investigation allowed the author to follow Partinigton's (1998) advice for building grounded theories of managerial behaviour, thus the constructs of enablers and inhibitors within the conceptual framework were built upon (1) data that were consciously perceived and or presented by the participants involved in the research; (2) data from underlying causal mechanisms that were neither perceived by the participants nor theoretically preconceived by the researcher, "... which, therefore, act independently of thought, and which are only accessible through the creative speculation by the researcher of plausible alternatives - whose 'truth' is ultimately dependent on consensual validation by informants" (Partington, 1998:13). And finally, (3) data which were collected from direct and indirect observations by the researcher.

In acknowledgement of Mohr's (1982) concerns of the tendency to present conceptual frameworks of innovation as over-simplified stages in a process, the conceptual framework developed in this first wave of research (overviewed in section 4.3 and illustrated in Figure 4-10) brings together both a processual and systemic view of innovation. It features four 'stages' and four forces that influence each stage. This integration allows for an emphasis to also be made of the values and beliefs of management practitioners that underpin the bringing together of resources and processes. These factors are considered in the contexts of both the organisational ecology and the external environment, thus a systemic model has been developed, which does not only simply convey a staged process. Although the conceptual framework has mostly been described as a mix of discrete stages and influences (section 4.3 and Figure 4-10), this is somewhat misleading but necessary to reduce complexity to a presentable and comprehendible level. The reader is asked to note that the conceptual framework aims to adopt a stance similar to that proposed by Jelinek and Schoonhoven (1990), from which the constructs are viewed as interwoven, interdependent and mutually involved.

Therefore, the conceptual framework delivers an holistic understanding of the key facilitators and inhibitors faced by management practitioners wanting to enable potentially disruptive innovations within non-best-in-class organisations. The framework presumes that best practice innovation procedures will be followed by management practitioners pursuing sustaining innovations. Thus it is the contention of the author that the results of the investigation presented thus far demonstrate the achievement of the first research objective.

The next chapter will present the results of the second half this investigation, this builds upon the inhibitors and enablers presented above. The chapter will identify the most critical areas of management cognition and management action to which the pursuit of potentially disruptive innovations are most reliant. It will show how a deeper investigation of the most pertinent area has resulted in the development of a management intervention that can be used to support the pursuit of disruptive innovation.

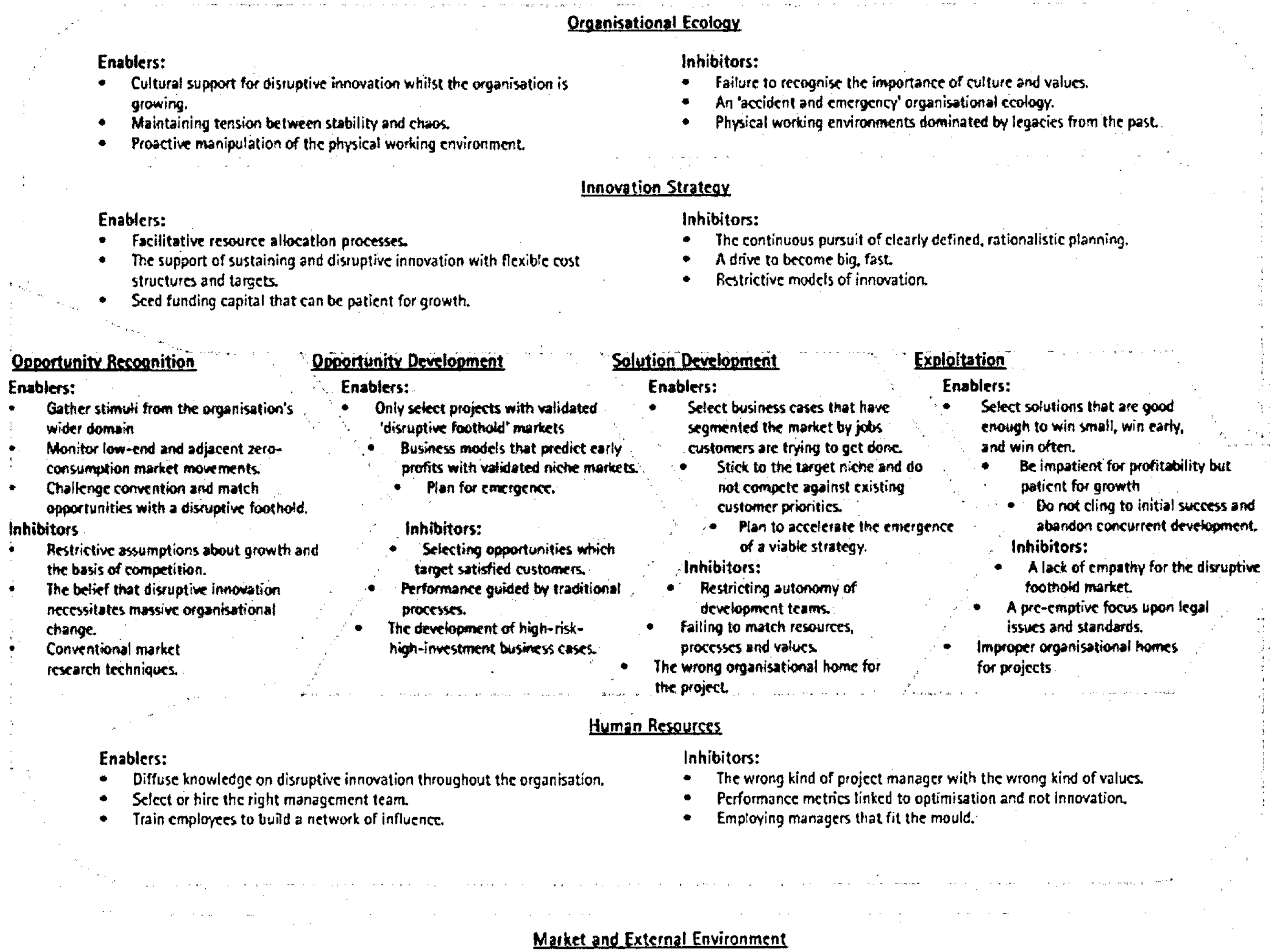


Figure 4-10: A conceptual framework for the pursuit of potentially disruptive innovations.

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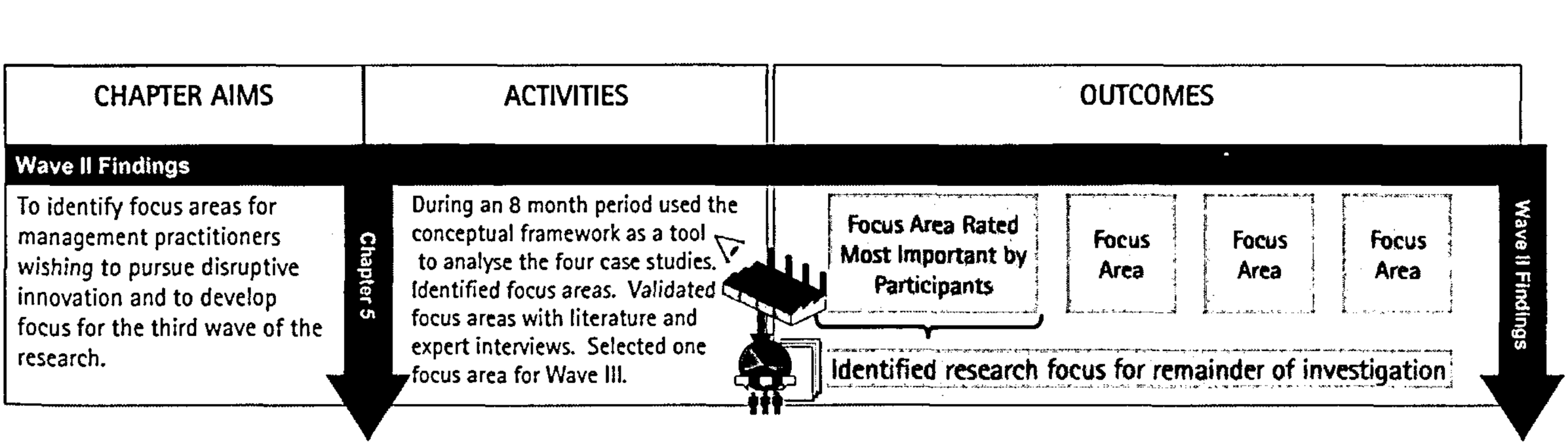
5. Four Main Barriers to the Pursuit of Potentially Disruptive Innovations: Where Senior Managers Should Focus their Attention

- The Findings from Wave II of the Investigation

This chapter is dedicated to presenting the results of the second wave of research activity. An overview of the objectives is provided followed by a description of four managerial focus areas that emerged from the research tasks - they are described as barriers to the pursuit of potentially disruptive innovations. The chapter will show how one of the focus areas was prioritised as most important by the industrial collaborators, and how this, consequently, became the focal point for closer investigation in the close of this chapter and throughout the remainder of the research.



5.1 Introduction

5.1.1 Overview of primary objectives

The four primary objectives of the second wave of this research are:

1) To use the conceptual framework (developed in the first wave of this research) as a tool to reveal, within each of the participating cases, areas of management action and management cognition to which the delivery of potentially disruptive innovations are considered most dependent.

2) To use the multiple perspectives, case pairings and juxtapositions available in collaborative research, to generate cross case analysis that can identify generic focus areas for managers pursuing disruptive innovation.

3) To build a base of evidence from case data, survey data and the literature that will sharpen, refine and define the emergent priority focus areas.

4) To prioritise one focus area, to investigate it in more depth and to create a specific research focus for the final wave of the current inquiry.

5.1.2 Overview of research methods

Data were collected over an 8 month period from the following sources:

- 4 semi-structured interviews with senior case study participants.
- 3 semi-structured interviews with innovation experts (who were external to the research group).
- 1 three-day multi-functional, multi-level workshop with all four case study organisations (15 participants in total).
- Multiple informal email discussions.
- 2 telephone conferences with senior management/engineer teams from cases A and B.

The triangulation of data from these sources and the enfolding of literature revealed four priority focus areas, which were in effect barriers that management practitioners face in the pursuit of disruptive innovation. The data analysis also led to the prioritisation of one of the focus areas as a barrier that seems to inhibit management practitioner's more that the others. This led to the emergence of a research focus for the third wave of the investigation. These results are presented in sections 5.2 to 5.9 of this chapter.

5.2 The emergence of managerial focus areas for innovation practitioners

The results presented below are a summary of the within case and cross case analyses that were conducted to reveal the four most critical areas of management action and management cognition to which the delivery of potentially disruptive innovations are most dependent.

5.2.1 The results of the within-case analysis: case specific priority focus areas

A focused within case analysis was conducted for each of the four case study organisations. The aim was to identify, for each case, management priorities or focus areas for the pursuit disruptive innovation. The conceptual framework, developed in the first wave of research activities (Chapter 4, Figure 4-10), was used to facilitate this process. For example, Figure 5-1 illustrates how Case C utilised a large graphical template of the conceptual framework to focus their conversation and to capture their insights and opinions.

Figure 5-1: The output of Case C's graphically facilitated conversations regarding critical focus areas.

Following the within case analysis (process described in Chapter 3), senior practitioners from each case study organisation presented what they perceived to be their organisation's top four management priorities. The management priorities were the key areas where it was believed management must focus their attention to enable the pursuit of potentially disruptive innovations. Figures 5-2, 5-3, 5-4 and 5-5 illustrate the high-level priority areas identified from the within case analyses of cases A, B, C and D respectively.

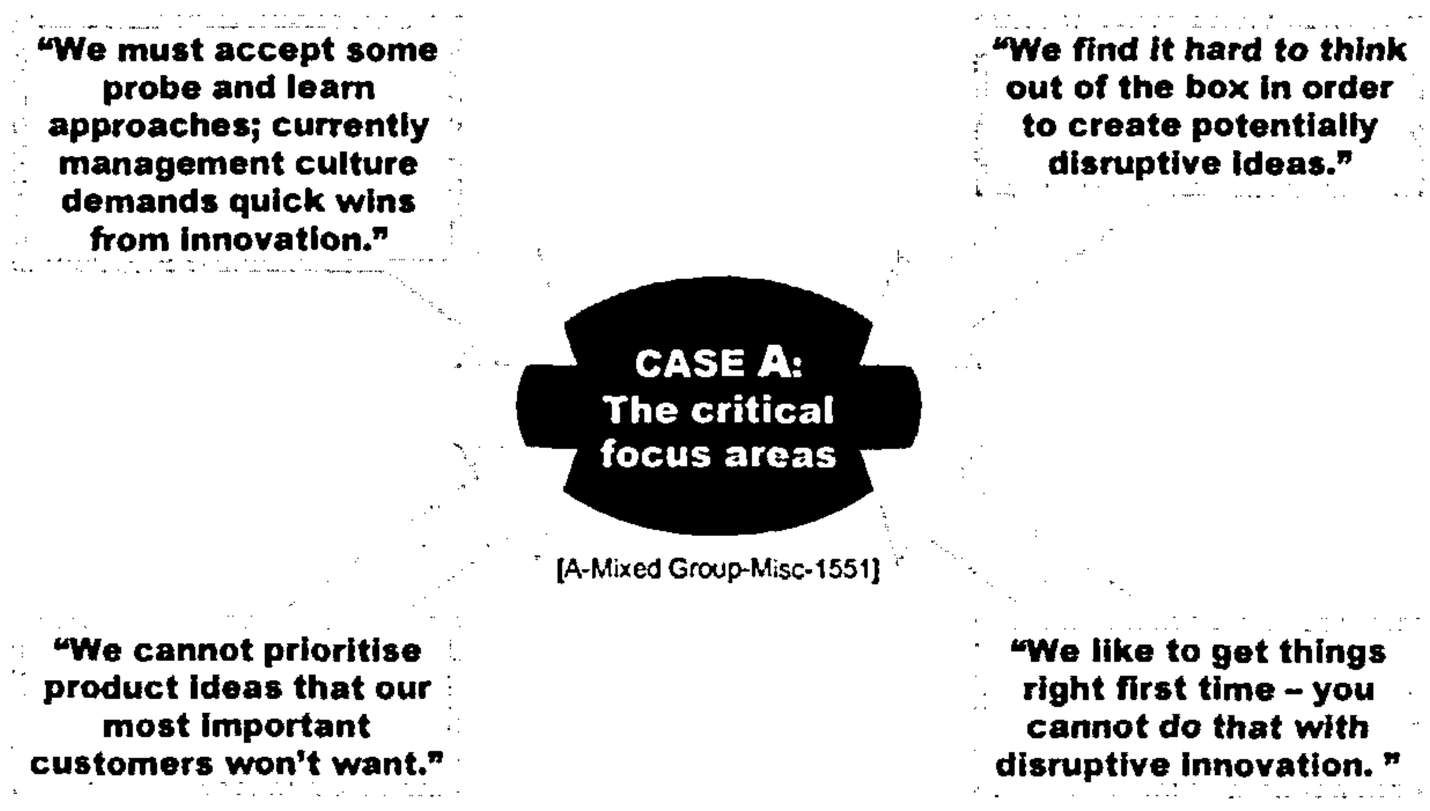


Figure 5-2: Within case analysis reveals Case A's four priority focus areas

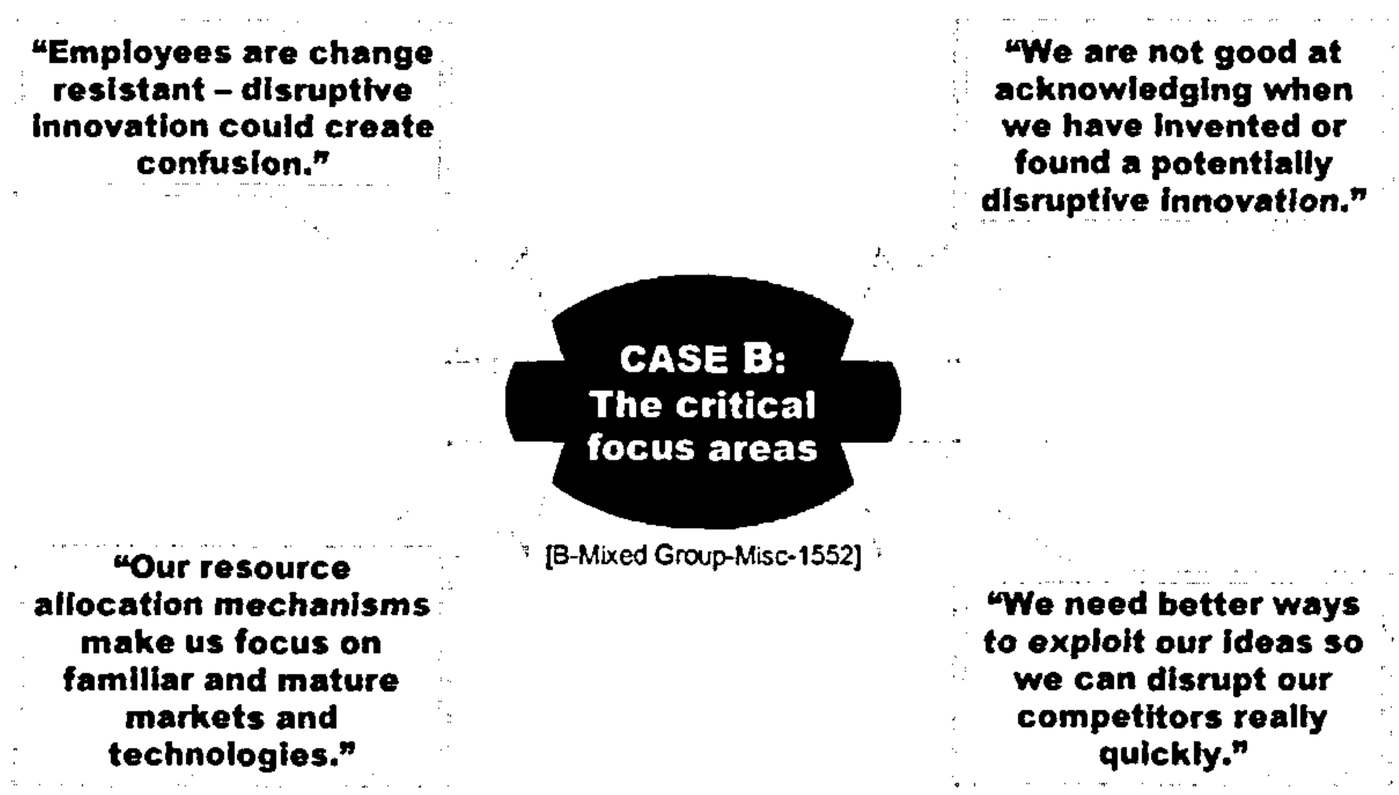


Figure 5-3: Within case analysis reveals Case B's four priority focus areas

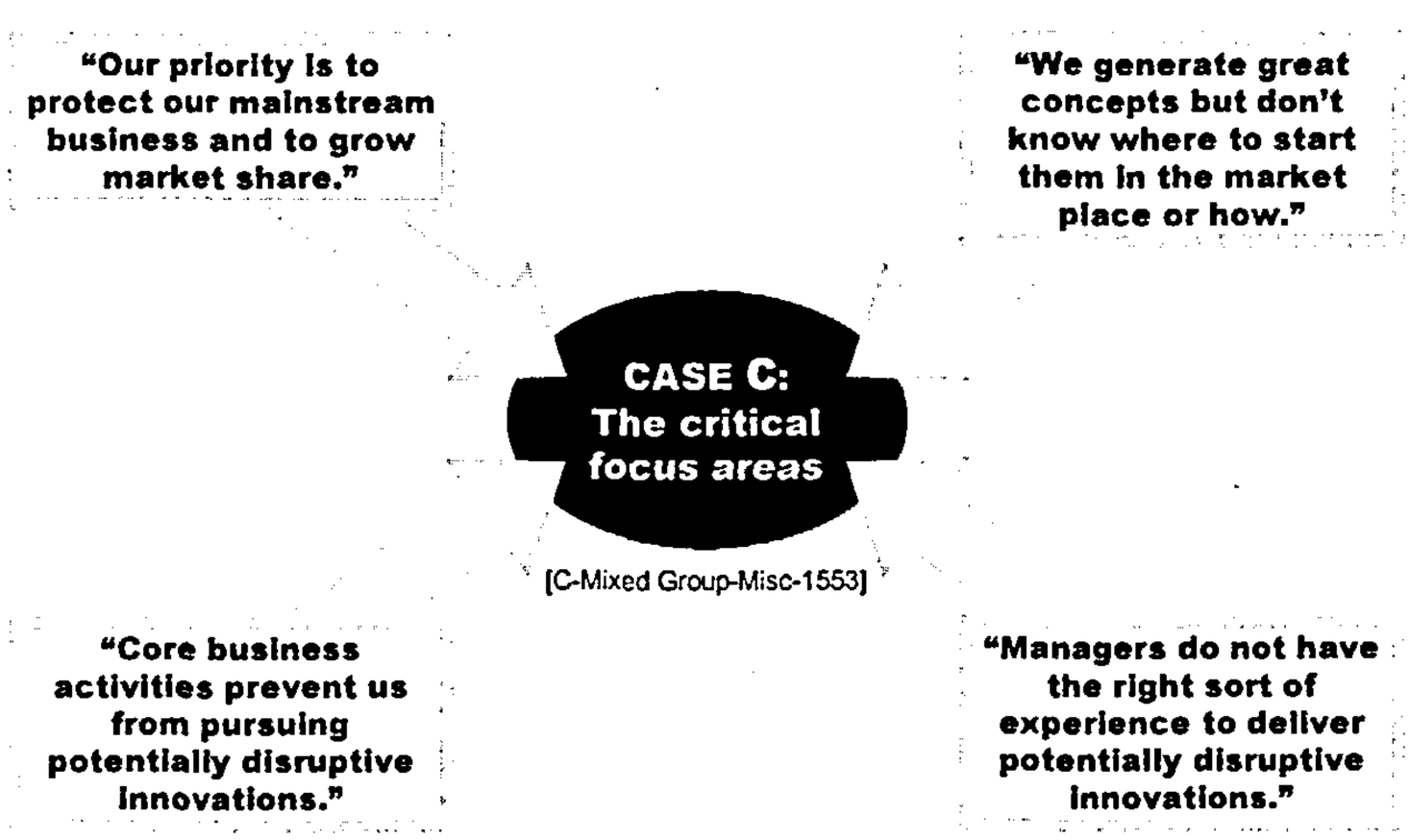


Figure 5-4: Within case analysis reveals Case C's four priority focus areas

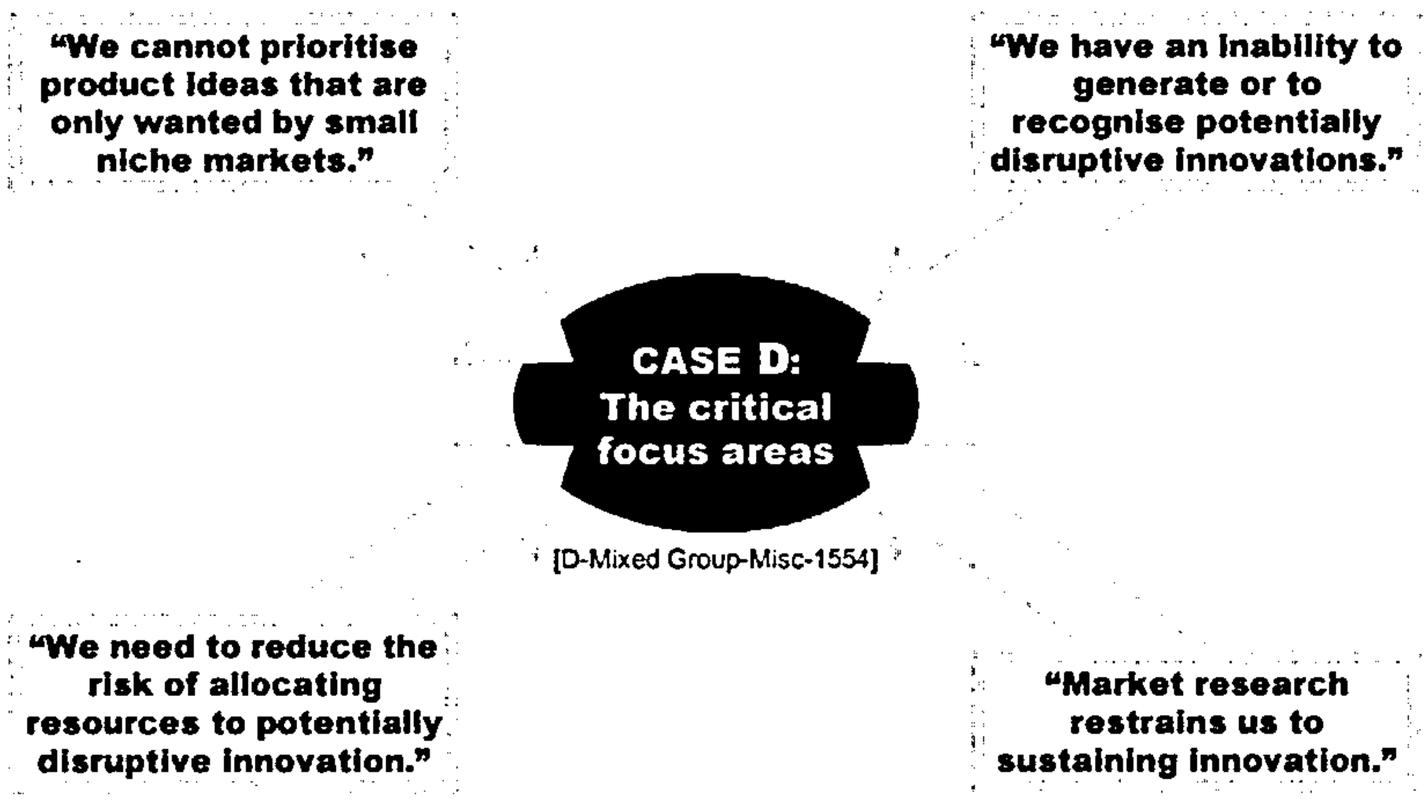


Figure 5-5: Within case analysis reveals Case D's four priority focus areas

5.2.2 The results of the cross-case analysis: four generic priority focus areas

Three focused cross-case analysis sessions were conducted, both by the entire research group and then independently by the author, to verify the results. The aim was to identify, cross case patterns – in terms of similarities and differences – across all of the case specific management focus areas identified in the within-case analyses.

The multi-case, multi-functional, multi-level discussions encouraged the senior practitioners, from each case study organisation, to challenge and compare what they perceived to be their organisations' top managerial focus areas. For example, Case A reported a "We cannot prioritise product ideas that our most important customers won't want". This on the surface appeared to be analogous to Case D's statement "We cannot prioritise product ideas that are only wanted by small niche markets". However, when comparing the deeper, case specific meaning of these statements, it became clear that the management teams of the two businesses meant different things. The former was a reference to a lack of strategic understanding regarding the importance of disruptive innovation and the latter was more concerned with justifying the allocation of resources. Moreover, similarities were not always obvious; the comparison of seemingly different focus areas revealed common linkages. For example, Cases B and C reported respectively "We need better ways to exploit our ideas so we can disrupt our competitors really quickly" and "Managers do not have the right sort of experience to deliver potentially disruptive innovations". During the comparisons

of the deeper underlying case specific meanings of these statements, it became clear that both businesses had raised very specific elements of a more general issue that was affecting all the collaborators - traditional new product/service development routines were constraining and killing potentially disruptive opportunities.

The trusting nature of the group allowed open discussion and surfaced an unexpected realisation that the representatives of all four organisations were effectively describing the symptoms of the same four root-cause obstacles to the pursuit of disruptive innovation. The participants were in fact using different words, from their different perspectives, but the semantics of the deeper causal issues were the same. Thus, the collaborative approach had surfaced an unexpected breakthrough - the emergence of four focus areas that were a common priority to all four cases (Table 5-1).

Case A's Priority Areas	Case B's Priority Areas	Case C's Priority Areas	Case D's Priority Areas		Restructured and Refined Priority Areas
"We need quick wins from our innovation investment."	"Employees are change resistant – disruptive innovation could create confusion."	"Our priority is to protect our mainstream business and to grow market share."	"We cannot prioritise product ideas that are only wanted by small niche markets."	⇒	The strategic importance of disruptive innovation is not addressed as it is poorly understood.
"We find it hard to think out of the box in order to create potentially disruptive ideas."	"We are not good at acknowledging when we have invented or found a potentially disruptive innovation."	"We generate great concepts but don't know where to start them in the market place or how."	"An inability to generate or to recognise potentially disruptive innovations."	⇒	An inability to identify or to generate a disruptive foothold market.
"We like to get things right first time – you cannot do that with disruptive innovation."	"We need better ways to exploit our ideas so we can disrupt our competitors really quickly."	"Managers do not have the right sort of experience to deliver potentially disruptive innovations."	"Market research restrains us to sustaining innovation."	⇒	Traditional new product/service development routines.
"We cannot prioritise product ideas that our most important customers won't want."	"Our resource allocation mechanisms make us focus on familiar and mature markets and technologies."	"Core business activities prevent us from pursuing potentially disruptive innovations."	"We need to reduce the risk of allocating resources to potentially disruptive innovation."	⇒	Inappropriate resource allocation routines.

Table 5-1: Illustrating how the cross case analysis facilitated the emergence of four priority focus areas.

5.2.3 Selecting a priority focus area

The first two aims presented in section 5.1.1 had been satisfied with the results presented above. The next two aims involved (1) building a base of evidence to sharpen, refine and define the four emergent priority focus areas and (2) to identify, from these focus areas, a focus area that the industrialists were keen to prioritise and concentrate upon in the final stages of this research.

Although some debate existed about the ordering of importance of three of the focus areas highlighted above, inappropriate resource allocation routines was rated by the industrialists from all four case study organisations as the top priority that must be addressed (Table 5-2). Furthermore, of the 11 'experts' interviewed throughout this inquiry, 10 highlighted the ability to secure resources as a top priority. Therefore, it was this focus area that became the main focal point of the remainder of this inquiry[5-1].

Priority focus area of management action/cognition	Case A's Priority Ranking	Case B's Priority Ranking	Case C's Priority Ranking	Case D's Priority Ranking
Inappropriate resource allocation routines.	1	1	1*	1
The strategic importance of disruptive innovation is not properly understood.	4	2	1*	4
An inability to identify or to generate a disruptive foothold market.	3	3	3	2§
Traditional new product/service development routines.	2	4	4	2§

* = Rated as joint first priority.

§ = Rated as joint second priority.

Table 5-2: Inappropriate resource allocation routines are rated as the top barrier to disruptive innovation.

Sections 5.3 to 5.6 of this thesis present a description of each of the four restructured and refined focus areas. Each section presents illustrative evidence from each case that is considered to be largely representative of the data set. This is followed by a description of the focus area in terms of

[5-1] The decision not to focus upon the diffusion of knowledge on the strategic importance of disruptive innovation was influenced by Noda and Bower's (1996) contention that strategy making is a process of resource allocation routines. Thus it is believed that diffusing knowledge on disruptive innovation must be addressed within the context of the resource allocation agenda.

its interrelation with the pursuit of potentially disruptive innovations and an explanation which draws upon the wider data set, including expert interview data, and relevant literature. Appropriately, more emphasis is given to the prioritised focus area; hence section 5.6 presents a deeper analysis of the data and the relevant literature. Jelinek and Schoonhoven (1990) note that constructs or dimensions of an organisations innovation effort are rarely, if at all, independent from one another. Likewise, the four managerial focus areas identified by this research are not mutually exclusive; they interrelate, interact and, as will be shown, even share dependencies with one another.

5.3 The strategic importance of disruptive innovation is not addressed as it is poorly understood

5.3.1 Evidence from the cases

The four text boxes below present illustrative evidence from each case; they are considered to be largely representative of the data set and portray a feel for the barrier to disruptive innovation caused by lack of strategic understanding of the importance of this phenomenon.

Evidence – Case A: "When we all started this [began the current research project] I thought that disruptive innovation would be a nice thing to do... now I realise that it is the only way we'll survive in our main market and perhaps the only way we'll break into another market with any real chance of staying there... I've now got to get the rest of the business to understand this." [A-Director General-IS-2749 & A-Director General-OE-2750]

Evidence – Case B: "We came to this meeting believing that going for DI [disruptive innovation] at [Case B] would mean asking people to go through big changes... the real issue is that people don't know how important DI [disruptive innovation] is... If we can spread this understanding then we'll have support from the top and the factory line – improving understanding underpins everything." [B- Sub Divisional Director of R&D-IS 2764 & B- Sub Divisional Director of R&D-OE 2765]

Evidence – Case C: "Our executive management say innovation is the most important priority - but they don't walk the talk... all they are interested in is protecting and growing our main business. ...this just goes to show they don't understand how important DI [disruptive innovation] is. If they did, they'd let us get on with improving operations and fighting for market share and they'd put some real effort behind shaping a new future for this company." [C-Senior Manager-OE-2823]

> *Evidence – Case D: "We will see what we think could be a potential DI [disruptive innovation] for one of our clients, but they stop us and prefer to pay for something that is radical but basically 'more of the same'... We wanted to introduce mechanisms to stop core businesses from stealing resources from potential disruptions and focusing us on familiar products and markets. Perhaps, this is too complex – what's really needed is a way to educate these executives about disruptive innovation and how important it is." [D-Divisional Head-IS-2126]*

5.3.2 A description of the focus area

Once this focus area was identified, each case study organisation was asked to use the conceptual framework (developed in the first wave of this research) to describe the influence of a low understanding of the strategic importance of disruptive innovation - in terms of its impact upon organisational innovation effort. The data gathered conclusively illustrates that it underpins every inhibitor and undermines every enabler of the pursuit of disruptive innovation displayed in the conceptual framework. Of particular concern, was the fact that this barrier creates restrictions within innovation strategy, influences rewards and recruitment within human resource management and underpins an unsupportive organisational ecology. Thus, it is believed efforts directed at changing innovation processes to support disruptive innovation will be strangled unless the knowledge deficits represented by this barrier are addressed. A low understanding of the strategic importance of disruptive innovation was therefore viewed as the root to the remaining three priority areas.

For decades the literature has, time and again, espoused the importance of a strategic commitment to radical forms of innovation (Knight, 1967). Cottom, Ensor and Band (2001) studied high performing organisations in an attempt to benchmark a strategic commitment to innovation. They conclude that organisations with executive level commitment, both in terms of written strategy and the embodiment of a responsible director, were more likely to pursue and deliver highly innovative output. Power or influence over the delivery of radical innovation has been reported to be at its highest within the executive management teams and at its lowest within the general workforce (Knight, 1967; Christensen, 1997; Wheelwright and Clarke, 1992). Therefore, it could be argued that knowledge regarding disruptive innovation must be diffused across the upper echelons of today's organisations if the pursuit of disruption is to be realised. The participants, from the case study organisations, support this notion in their calls for executive management training regarding the importance and implications of disruptive innovation.

However, stories in the business press and academia alike, recount examples of middle managers who have garnered informal organisational power and have eventually been able to deliver or

thwart the development and exploitation of breakthrough new products or services. For example Obeng (2003), Rosen (2002), Stacy (2000), Dalton (1959) Gouldner (1954) and McMillan (2004) all show how middle managers, to a greater or lesser degree, create cohort groups, form coalitions, undertake bootleg operations and take advantage of unanticipated changes to bring their ideas to fruition. Therefore, the strategic importance of disruptive innovation must be diffused more widely than the top management team. Data from the expert interviews indicates this knowledge must permeate all areas of the business with strategic leverage, both formal and informal. Kaplan's observations within Hewlett Packard (1999) similarly conclude that organisations must infuse "a new common sense... one that suggests that technologies and organisations are born, grow, decline and are born again... to understand that a technology – and the company whose future success depends upon it – will eventually face the end of its lifecycle, inspires urgency for, and commitment to, discontinuous innovation" (p21).

5.4 An inability to recognise or to generate a disruptive foothold market

5.4.1 Evidence from the cases

The four text boxes below present illustrative evidence from each case. They are considered to be largely representative of the data set and portray a feel for the barrier to disruptive innovation caused by an inability to recognise or to generate disruptive foothold markets.

Evidence – Case A: "We find it hard to think out of the box in order to create potentially disruptive ideas." [A-Director General-OR-2573].

Despite claims of a lack of creativity, further involvement with Case A revealed that their engineers and technicians were very good at generating new and unusual ideas. In fact, they had the capability to build new product offerings with disruptive potential; what they actually lacked was the capacity to position the new concept in a low-end or new-market disruptive foothold.

Evidence – Case B: "... we've been looking for new ideas and technologies that could instantly replace existing products and processes. Now I get it... we need to find ways to make these unusual ideas profitable in smaller markets to see if they can be viable. We thought that we faced a lack of disruptive ideas, but we don't; our problem is which markets do you start in?" [B-Senior Engineer-OR-2580]

Evidence – Case C: "It's clear to me now... we simply don't know where to start these new [potentially disruptive] ideas or how to do it properly... Perhaps the pressure to always go straight to our main customers is more risky, but at least we know these people." [C-Senior Manager-OR-2589]

Evidence – Case D: "After this discussion I think I understand our clients' problem better... people can always make new great ideas, they can think out of the box and be wild if they're allowed, but it's finding customers who'll be willing to pay - that's the big problem." [D-Senior Consultant-OR-2601]

5.4.2 A description of the focus area

The analysis of data captured from the cases and expert interviewees reveals this management priority is, in effect, an embodiment of the 'Opportunity Recognition' construct (identified and described in the conceptual framework that emerged from the first wave of this research). Opportunity recognition is a more specific act then pure invention (Leifer et al., 2000). An opportunity for a radical (or potentially disruptive) innovation is recognised when a technical invention or a concept for a customer offering has been matched with the needs of a market with a compelling reason to buy (O'Conner and Rice, 2001; Leifer et al., 2000). It would appear that average performing businesses, such as the cases involved in this research, may be initially inclined to blame a lack of creative ideas for their lack of potentially disruptive opportunities. However, the data indicates organisations are more likely to suffer with the inability to recognise or to generate disruptive foothold markets, than they are to suffer a lack of ideas.

Christensen and Raynor (2003) state that faulty market segmentation schemes help to explain high rates of failure in new product development. They continue to state that management teams must make it their priority to reconsider how they segment the market place when they are assessing new ideas. Expert interviewee TH recognised this management priority, as did all of the experts interviewed in the course of this investigation. In an email, he explained how his organisation uses bi-monthly idea generation and idea development workshops. These are designed to specifically overcome the problems with recognising or generating disruptive foothold markets:

"... a key approach in these workshops is the combination of societal and technological trends into to new product ideas... with a 'no-doors' architecture [everyone is welcome to join in] and a creative and open culture, the generation of disruptive ideas is supported, as all concepts are firmly based on market needs, or at least expected needs." [TH-Senior Consultant-OR-1021]

Descriptions of the main enablers and inhibitors of opportunity recognition, using case evidence and the findings of key academic authors, are provided in section 4.3.1 of chapter four in this thesis. Integral contributors to the inability to recognise or to generate a disruptive foothold market were witnessed in the data and the literature to be:

- an unwillingness to challenge conventions,
- restrictive assumptions about growth and the basis of competition,
- a lack of consideration for the organisation's wider competitive and market domain, and
- an inability to segment markets in new ways.

Evidence provided by Evans, Burns and Barrett (2003) adds to this base of understanding. They show how getting "inside the head" (p4) of customers and users with empathic design can help to break assumptions about early stage ideas, whilst identifying a niche of customers who are most likely to be delighted by a new offering. The case study organisations involved in this research may well benefit from such an approach.

Furthermore, the issue of organisational leadership should be mentioned. Notions presented in Galbraith's recent work on "the economics of innocent fraud" (Galbraith, 2004) suggest that business leaders are perhaps guilty of losing their grip on a common sense that dictates we should pay more credence to our gaps in knowledge. Managers, in all four cases, reported they felt restricted by the models of innovation adopted by their (or their clients) executive management teams. They reported these inhibiting models simply ignored unfamiliar territories (that could be represented by gaps in knowledge) and restricted the search for innovation options, or appropriate markets for new technologies and concepts, to familiar arenas. This issue relates significantly to the previously described barrier: 'the strategic importance of disruptive innovation is not understood'. By overcoming this knowledge deficit, managers will be more inclined to tackle unfamiliar territories and will see the importance of challenging conventions (Allen et al., 1999; Hamel, 2000), only then will the techniques and strategies, which can be used to identify a disruptive foothold market, be adopted successfully.

5.5 Traditional new product and/or new service development routines

5.5.1 Evidence from the cases

The four text boxes below present illustrative evidence from each case. They are considered to be largely representative of the data set and portray a feel for the barrier to disruptive innovation caused by the use of traditional new product and new service development routines.

Evidence – Case A: "Because of competition from China our whole new product development process is based upon getting things right first time – from start to end... We know no other way... we need to learn to accept new approaches." [A-Quality manager-OD-2435 & A-Quality manager-SD-2436]

Evidence – Case B: "We at [Case B] thought that our major issue was at the end of the process – with exploitation and marketing – but it's not. We need to think about these commercialisation issues up front and then think about how we adapt our development process to suit more experimentation in the market place – you know this probe and learn stuff we've been talking about." [B-Senior Engineer-OD-1707 & B-Senior Engineer-SD-1708]

Evidence – Case C: "We initially highlighted that one of our key problems was a lack of management experience... After talking to you all [the research group] it's clear to us, at least, that this problem is wider... [Case C] is great at doing things better, but not supportive of doing things differently." [C-Executive Marketing Manager-SD-2650]

Evidence – Case D: "We've noticed at our clients and at [Case D] that market research restricts us all to focusing on the familiar... perhaps this is one of the most critical problems... but it's just one of many parts of traditional NPD [new product development] that we need to address and change when we are aiming for disruption..." [D-Divisional Head-OD-2632 & D-Divisional Head-SD-2631]

5.5.2 A description of the focus area

There was a tendency for participants from each of the cases to blame either creativity or a singular aspect of the new product/service development process for not generating or supporting potentially disruptive innovations. Likewise, to address gaps in knowledge, authors in the field of new product/service development have also isolated particular elements of the innovation process in their investigations. For example:

- Leifer et al., (2000) provide a comprehensive discussion of early stage activities in the new product development process that can prevent or enable organisations from recognising and developing radical (and potentially disruptive) opportunities.
- Although concurrent development is a highly effective approach for the delivery of sustaining innovations (Lettice, 1996; AitSahlia and Johnson, 1995), McDermott and Handfield (2000) provide evidence to illustrate these approaches hinder breakthrough innovation.
- Moore (1995, 1998, 200, and 2002) presents extensive anecdotal evidence to explain that a key failure of potentially disruptive innovations can be found in the exploitation phase.

Cross case examination of the data revealed that management should broaden their focus, to consider the impact of the traditional innovation approach, in its entirety as an interdependent process. Thus, an examination was made of the barrier caused by the use of traditional approaches to innovation in the context of the conceptual framework. The participants of the cases chose to focus this analysis primarily upon the constructs of opportunity development, solution development and exploitation – the interrelated process that the participants referred to as the 'innovation pipeline'.

The case study participants reported that new 'half-baked' ideas would enter their innovation pipeline and make their way through their organisations' development process, past a series of decision points where resources would either be allocated or withdrawn. Participants from each case believed that the singularity of their pipeline was one of the key reasons why many potentially disruptive ideas were lost, killed or ignored. Expert interviewee, TF, agreed:

> *"... as soon as I notice that my client has a single innovation process to develop all their ideas, I know instantly what will come out of the other end... simple, small step improvements on what they are doing right now... I tell them: 'what you need is a separate development funnel for breakthrough projects'... its got to have executive level support... [and] a more intuitive process is needed... no, intuitive doesn't mean less rigorous... [for example] there is plenty of tools that can help probe and learn, you know, and in a pretty scientific way" [TF-CEO-OD-2695 & TF-CEO-SD-2696]*

Thus, the data indicates that disruptive opportunities may require a separate parallel development process, as the tools, techniques and approaches, which allow management practitioners to approach disruptive innovation differently, appear to be counter-effective for sustaining innovation.

For example, the abandonment of concurrent development would cripple lead-times for the manufacturing cases involved in this study, but such abandonment could help them when pursuing potentially disruptive opportunities.

The concept of a parallel development process is not new, for example, Veryzer (1998) and Christensen (1997) propose that a separate parallel development process is essential for discontinuous and potentially disruptive opportunities. They assert that such a separation would help management practitioners to 'do better' with sustaining innovation and to 'do differently' for innovation that aims to break the steady state. The research presented by Linton and Walsh (2002), Rice et al., (2002), Dowd and Walsh (1998) and Kassicieh et al., (2002) suggests that a separate parallel process would rely more upon pattern recognition than on data-driven market analysis. Furthermore, a parallel process, for the introduction of radical or disruptive technologies, is likely to require the establishment of new communities of practice (Swan et al., 2002); for example, Sakkab (2002) illustrates how Procter and Gamble use new communities of practice as a means to manage the introduction of discontinuous technologies.

Moreover, the literature and the data, from the case study participants and the expert interviewees, demonstrate that executive management support is needed for a successful implementation of a new formal innovation processes (e.g. Hamel, 2000; Burgelman and Sayles, 1986). And furthermore, it is believed that employee reward-mechanisms must be adapted to implicitly and explicitly incentivise the workforce to use new processes (e.g. Amabile (1997) finds psychological and financial rewards are both important in inducing creativity and innovation). Thus, the evidence within the data indicates that a low level of understanding regarding the strategic importance of disruptive innovation could hamper attempts at developing an all important parallel innovation process.

5.6 Inappropriate resource allocation routines

5.6.1 Evidence from the cases

The four text boxes below present illustrative evidence from each case. They are considered to be largely representative of the data set and portray a feel for the barrier to disruptive innovation caused by inappropriate resource allocation routines.

Evidence – Case A: "When I said that we can't prioritise ideas for products that our most important customers won't want, I guess we were saying our processes are not right... our resources always revolve around short-term deals that service our main customer... they say "Jump!" and we ask "How high?". We must break this habit. [A-Director General-IS-2111]

Evidence – Case B: "I really believe we have some great ideas and some potentially disruptive innovations for sure... But as soon as a large project comes up for one of our main technologies, or with a major customer, all the resources get sucked away from these things on the periphery... how can we stop this happening?" [B-Sub Divisional Director of R&D-1696]

Evidence – Case C: "Yeah [in response to the participant from Case B above] we experience exactly the same problem. The head of my division says letting our core business dominate is a cultural issue... A lot of us are beginning to think differently... this is absolutely an issue of how our executive management routinely allocates resources" [C-Senior Manager-IS-1697]

Evidence – Case D: "We came here saying we need to 'de-risk' going for DI [disruptive innovation]... the risk is of course financial. We need to learn better financing practice. We need better ways of presenting the figures for these [potentially disruptive] innovations... if we can make them look like a lower financial risk, then we will be able to justify them more." [D-Senior Consultant-IS-2657]

5.6.2 A description of the prioritised focus area

Intel's former chairman, Andrew Grove, states that "To understand companies' strategies, pay attention to what they do, rather than what they say" (Grove, 1996:146). In effect, this means the strategy which is actually delivered by a company is what comes out of its resource allocation process – a notion supported by Noda and Bower (1996). "To remain successful in today's world, managers and organisations must be ambidextrous and able to implement both incremental and revolutionary change" (Tushman and O'Reilly, 1996:8). Thus companies must seek to develop strategies that simultaneously pursue and deliver sustaining and disruptive innovations. Accordingly, this will necessitate an organisation's managers to allocate resources to both efficient responses to core customer demands, and corporately entrepreneurial activities in new and/or low-end niche markets (Tushman and O'Reilly, 1996, 1997, 2002; Bower and Christensen, 1995; Phaal et al., 2004, Leifer et al., 2000).

This conclusion puts significant pressure upon resource allocation routines, which is further enhanced when considering that the multitude of practitioners involved in this investigation identified funding routines to be the top barrier to the pursuit of disruptive innovation. Therefore, the remainder of this section reviews relevant literature and presents examples of data gathered during this investigation [5-2].

5.6.2.1 What is resource allocation?

Ansoff's (1965) seminal work on corporate strategy, explains that management practitioners attempt to achieve their objectives through the "... conversion of resources into goods and or services and then obtaining a return on these by *selling*[5-3] them to customers. There are three types of resources: physical (inventory, plant), monetary (money, credit), and human. All three are used up in the conversion process... " (Ansoff, 1969:4). He continues to state that "... entrepreneurially orientated managers would view the firm as a pattern of investments [options to which resources can be allocated] to be amended and changed when better opportunities arise." (Ansoff, 1969:131). Ansoff's simple overview defines the term 'resources' and illustrates the purpose of the allocation process. And although today's understanding of the resource allocation issue is vast and more complex, the same heart still beats at its core. For example, Dougherty and Hardy (1996) stated that "An organization with both innovation projects and mature businesses ideally will have a resource system that channels money, equipment, expertise, and information to all these activities simultaneously. This resource system should also nurture new ideas and continuously raise and solve problems [to improve existing customer offerings and existing processes]" (p1122)

But what does this mean for today's management practitioners in pursuit of disruptive innovation? In what context do they make their decisions? How dynamic is the allocation process? What sort

[5-2] Given time and space limitations, it is not possible to synthesise all the past and prevailing opinions and debates concerning the resource allocation issue. Instead, a selective overview of key research is presented to provide a better understanding of the nature and complexity of the resource allocation process in today's companies that aim to pursue potentially disruptive innovations.

[5-3] The word 'selling' is in italic in the original text.

of mechanisms support and prevent resources from being allocated to potentially disruptive opportunities? The remainder of this section will attempt to shed light on the answers to these questions.

5.6.2.2 Operationalising resource allocation for disruptive innovation: The decision context

Building upon Ansoff's perspective, Joseph Bower's (1970) seminal work laid the foundation of the modern day process models of resource allocation. His book describes how initiatives surface in a bottom-up manner and then compete for approval and resources, which are often scarce (especially management attention), within the organisation's managerial and administrative systems and its strategic context. Bower (1970) focuses his work upon the organisation's managerial and administrative systems, which he refers to as the structural context in which resource allocation decisions are made. He acknowledges the influence of the situational context, the personal values and beliefs of management practitioners, but pays less credence to its importance.

Burgleman (1983) attempted to extend Bower's work through analyses of corporate venturing processes in major diversified businesses. Like Bower, he describes the bottom-up emergence of investment options and focuses upon early stage approval and the competition for resources within the structural context. He specifically notes the importance of reward and compensation mechanisms and performance measurements, such as financial hurdles for project selection; however he extends the discussion to include organisational structure in terms of levels of centralisation and decentralisation. Burgleman's later work (Burgleman and Sayles, 1986; Burgleman et al., 1996; Burgleman, 2002) increasingly evolves the concept of the structural context to include Bower's overlooked situational context: "The structural context encompasses administrative (e.g. resource allocation rules) and cultural (e.g. rules of expected behaviour) mechanisms." (Burgleman et al., 1996:494).

Therefore, the context that will influence a management practitioner's decision to allocate and provide resources to a potentially disruptive innovation can be described in a mechanistic structural form, or a less tangible situational arrangement. By integrating this knowledge with Leonard-Barton's (1992) examination of organisational capabilities, an improved description of the decision making context can be achieved (Table 5-3)

Burgleman-Bower Categorisation	Leonard-Barton Categorisation	Examples garnered from all three authors:
Structural Context	Management systems	The structure and procedures of the business: *- Systems that determine how the business is structured and who has responsibilities.* *- Procedural systems such as resource allocation, human resource management, budgeting, training etc.*
	Human resources	The people employed by the business: *- Knowledge and skill assets.* *- Networks of contacts.*
	Physical recourses	The tangible non-human assets of the business: *- Inventory, plant (factory/offices), monetary (money, credit).*
Situational Context	Cultural systems	The collective and individual value and beliefs held within the business that influence prioritisation decisions:

Table 5-3: Factors that will affect the resource allocation decision making context.

This analysis provides an insight into the context that will influence a manger's decision to allocate resources. However, as previously stated, both Bower's and Burgleman's early work pay attention to the approval of resources and the initiation of projects, not the ongoing innovation process. Accordingly, resource allocation should also be considered in relation to the ongoing nature of innovation management and new product/service development processes. When such a consideration has been made, the data collected in this investigation, which pertains to the resource allocation process, can be more effectively scrutinised.

5.6.2.3 Operationalising resource allocation for disruptive innovation: An ongoing process?

The approach adopted by Bower and Burgleman in their early work overlooked the continuous nature of innovation management. Trott (1998) offers a management framework to describe this very phenomenon (Figure 5-6). When considering resource allocation and the pursuit of disruptive innovation within Trott's framework, it is clear that the decision to allocate resources to an innovation initiative is not a one off event but an integral continuous process. Management practitioners will continually face resource allocation decisions that will impact the fate of innovation projects from their early stages through to exploitation.

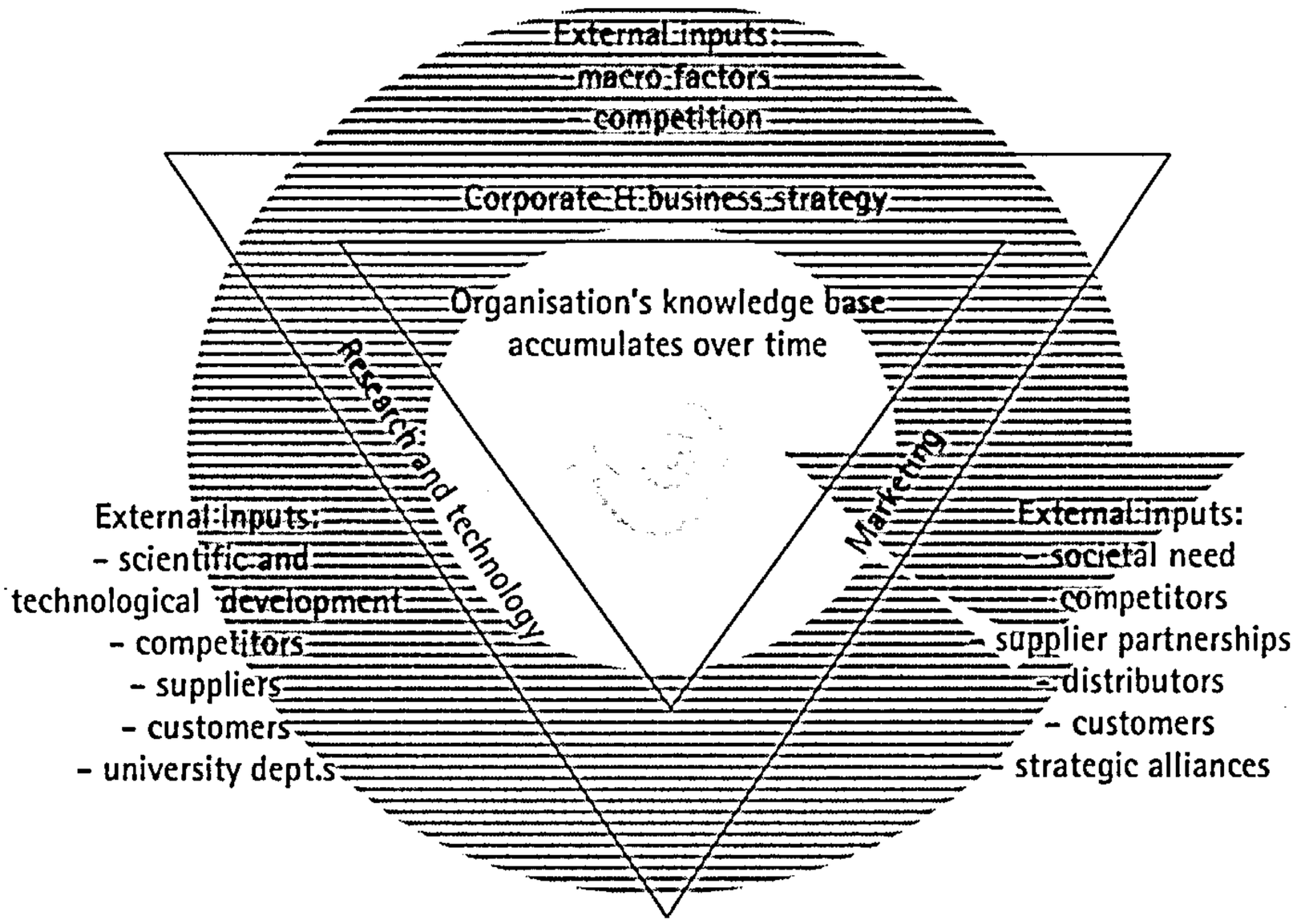


Figure 5-6: The Innovation Management Framework (adapted from Trott, 1998:21)

Likewise, in an attempt to address the gaps in Bower's seminal work, Noda and Bower (1996) examined the ongoing nature of decisions to continue or discontinue support for a new corporate business. They emphasised that capital investments were made in a serial process and that decisions to commit these resources were made through a continual process of proposals, approvals and (as was shown in chapter 4) the achievement of milestone operational targets. However, this work was limited to the approval of, and commitment to, a series of capital investments. Although emphasising the continual nature of resource allocation, it did not consider how practitioners approve and commit resources to a single development project with disruptive potential or a portfolio of investment options.

Christensen and Raynor (2003) present a model that places the resource allocation process at the heart of strategy actualisation (Figure 5-7). Their model presents both the formal and informal influences upon the resource allocation process and the cyclical nature of feedback within the ongoing decisions to approve and commit resources. This model further demonstrates that resource allocation and strategy delivery can be considered as two sides of the same coin and can, therefore, be linked to the findings presented in chapter four – e.g. the need to embrace emergent approaches if pursuing potentially disruptive innovations. This model can be used to explain the continuous nature of a single development project or a collection of projects and investment options; it also cleverly emphasises the importance of both emergent and deliberate strategy for the dualistic pursuit of sustaining and disruptive innovations (as do Lynn et al, 1996 and Kaplan, 1999).

However, it fails to illustrate Noda and Bower's (1996) notion, presented above, of the serial nature of investments.

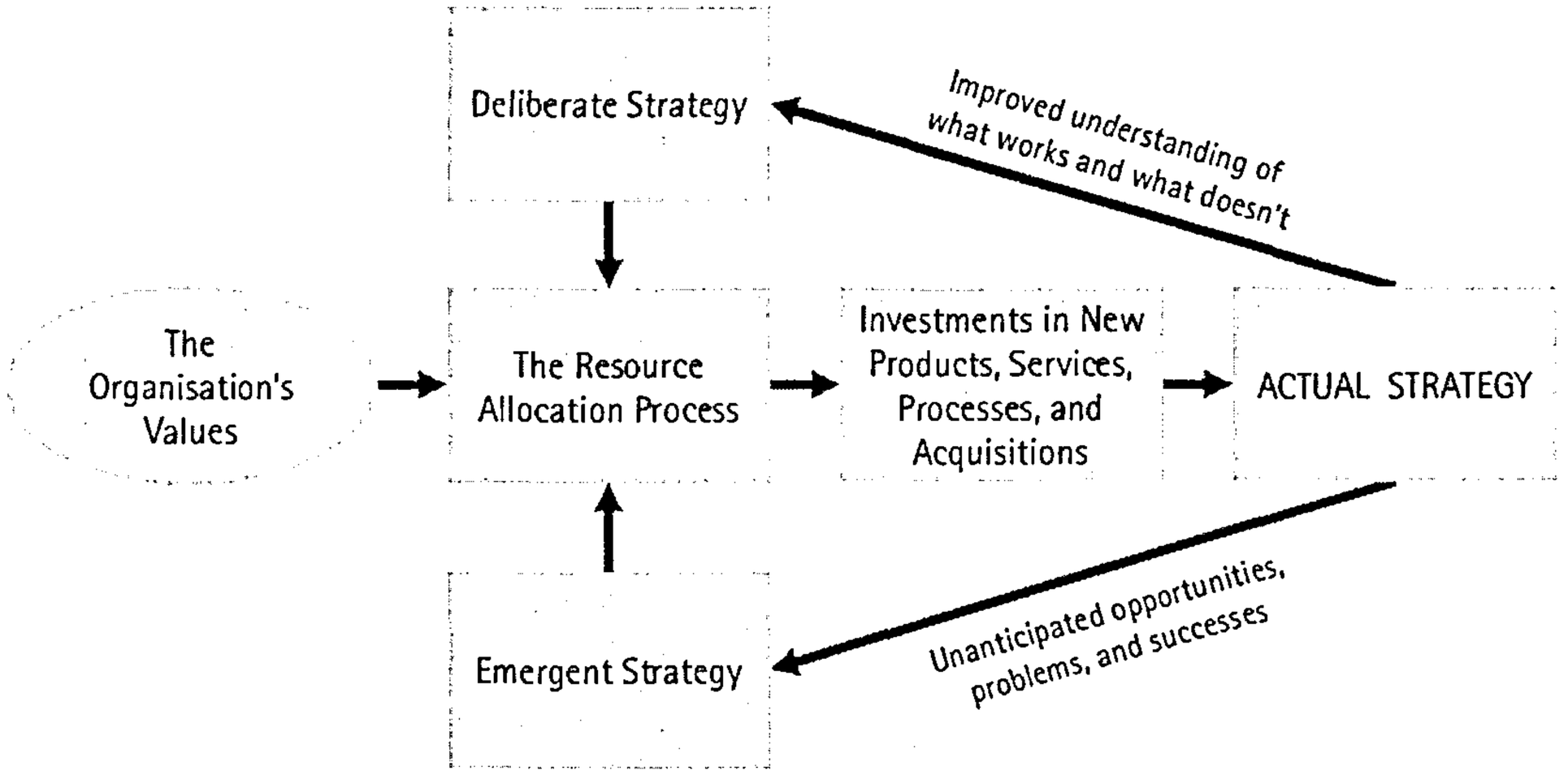


Figure 5-7: The process by which strategy is defined and implemented (Christensen and Raynor, 2003:215)

The common nature and the benefits and practices of staged funding approaches have been published by Cooper (1983), Cooper, Edgett and Kleinschmidt (1999) and Block and MacMillan (1985). Similarly, Vesper (1980) and Stevenson and Gumpert (1985) propagate the notion of staged funding for new entrepreneurial ventures. And the benefits of staged seed funding, specific to the pursuit of radical, breakthrough and potentially disruptive innovations, are discussed by Leifer et al. (2000) and examples of this in practice are provided by Rice et al (2002) and O'Connor and Rice (2001). It was also found in the first wave of this research that the pursuit of disruptive innovation is dependent upon staged seed funding capital that can be patient for growth (chapter four, section 4.3.5.3).

Therefore, if the understanding of a management practitioner's context for decision making is well advanced and the continual nature of resource allocation is appreciated, with regard to the pursuit of disruptive innovation, then an obvious question to ask is: Why are resource allocation routines rated as the key barrier to the pursuit of disruptive strategies?

5.6.2.4 Operationalising resource allocation for disruptive innovation: A breakdown between approval and provision?

It is commonly stated that resources do not always flow smoothly to innovation (e.g. Henderson & Clark, 1990) and even less so to the pursuit of disruptive innovation (e.g. Christensen, 1997).

Dougherty and Hardy's (1996) examination of 15 large, mature, organisations, concludes that embedded resource allocation routines contribute to the 'innovation-to-organisation' phenomenon - a fundamental barrier to radical and discontinuous innovation. They describe a common trend within many businesses, whereby operational aspects of the organisation are allowed to commandeer scarce resources from the pursuit of highly innovative action. Their evidence shows that:

- Resources were nearly always targeted toward established businesses, and individual champions did not have enough power to shift this imbalance.
- Individuals, that were new to the 'game', were unsuccessful in resource gathering because they lacked adequate internal networks or had no networks at all.
- Processes were to blame, as they failed to support innovation.
- Structures were to blame, as they nurtured functional fiefdoms and conservative decisions, rather than encouraging cross-functional activity and risk taking.

Remarkably, many of the businesses in Dougherty and Hardy's study insisted they were committed to innovation. There was clearly a breakdown between intended resource approval and resource provision.

The innovation, new product development and technology management literature has been summarised into three main themes. These themes reveal three primary reasons for the failure of an organisation's resource allocation routines to support the pursuit and the delivery of both sustaining and disruptive innovations:

1) The impact of 'resource dependencies'.

2) The 'path dependence' of organisational development.

3) The difficulties of simultaneously maintaining different strategy making and implementation processes for sustaining and disruptive innovations.

Burgelman and Sayles (1986) show that an organisation's mainstream customers almost never demand highly innovative or disruptive innovations. These are the 'people who pay the bills' and although they may want their products and services better, faster or cheaper they only ever voice their demand for 'more of the same'. Furthermore, their findings show that investors prefer to

garner dividends from safe investments. Pfeffer and Salancik (1978) state these phenomena create 'resource dependencies'; they explain how a company's freedom of action becomes limited to satisfying the needs of its main customers and the investors that give it the resources it needs to survive. These resource dependencies, therefore, appear to force practitioners to focus upon incremental and occasionally radical innovation.

Most of the practitioners from all four case study organisations reported, whether consciously or not, that their resource allocation decisions were bound by a dependence upon their resource providers (both customers and investors). For example, despite publicly committing to an intensive and broad innovation agenda, it was believed that most senior executive management teams are much happier to fund sustaining innovations as they do not want to risk devaluing their stock options. Furthermore, four of the seven industrial expert interviewees stated that resource dependencies were one of the most difficult problems to overcome when pursuing new lines of innovation.

An organisation's future is often said to be 'path dependent' (Penrose, 1995), "history matters; growth is essentially an evolutionary process and based on cumulative growth of collective knowledge" (p xiii). Thus an organisation's accumulated knowledge and experience of how it has delivered success can often dictate (or at least significantly influence) its future. Leonard-Barton (1992) notes, however, that an organisation's core competencies often become its core rigidities when pursuing 'new to the world' or 'new to the organisation' product development. Consequently, if the organisation cannot unlearn or learn new competencies fast enough, corporate entrepreneurial activities become inhibited and are perceived as high-risk options. In seeking to avoid risk, therefore, path dependencies compel practitioners to focus on incremental and at best mildly radical innovation.

Most of the practitioners from all four case study organisations and all but three of the expert interviewees reported, whether consciously or not, that their resource allocation decisions were bound by a dependence upon their organisational history. For example, it was observed that senior and middle managers, who want promotion, prioritise their time and resources to innovation initiatives acclaimed by their most valued customers and the most powerful executive management.

When a management team aims to deliver a sustaining innovation, it can consciously and rigorously analyse data from the current situation and its past experience (Cooper, et al., 2001). Typically, they can define a project with a beginning, middle and an end, and drive a 'top-down'

deliberate strategy (Ansoff 1965; Obeng, 2003). However, as discussed in chapters two and four (the literature review and the results of the first wave of this research), management practitioners, faced with delivering a potentially disruptive technology or business model, have to accept that nobody can know how this offering will be used at the outset (Brown, 1991). "Disruptive technologies [may not suit deliberate strategy approaches as they] present a difficult challenge for market forecasting. The one thing that is certain in forecasting the size of these markets is: the forecast will be wrong and often by orders of magnitude" (Cooper et al., 2001:218). As chapter four presented, a viable strategy has to emerge, through rapid probe and learn exercises within niche markets. Thus, resources have to be allocated to maintain strategic flexibility, in order to respond to emergent evidence (Christensen and Raynor, 2003). This is a very different approach to allocating resources to deliberate strategy formulation, in which returns on investment can be more readily assessed in terms of numerical contribution to the bottom line. These issues of strategic approach generate a two-fold problem, which significantly hinders the provision of resources to potentially disruptive innovations. Firstly, perceptions of risk increase when return on investments are difficult to calculate (Luehrman, 1998; Hellmann, 2002). Secondly, market pressures force many organisations to deeply embed the deliberate strategy process, to enable them to better respond to lead customers; consequently, they forget how to embrace an emergent approach (Mintzberg et al., 1998; Christensen, 1997).

Once more, these issues were raised by the majority of the senior case study participants. Of particular concern, was the observation that sales forces within each case study organisation preferred to allocate their time and resources to selling the products and services that they knew the best, to the customers they knew would be willing to pay the highest margins. There were few, if any, mechanisms to help the teams to probe and learn about new market niches. Furthermore, all four organisations presented major reservations regarding opportunities that lacked clear deliberate strategy. Doubts were raised both in terms of the difficulties in accepting unclear return on investments and in terms of a lack of ability (and motivation) to pursue emergent approaches.

In summary, an executive management team may state a strategic intent for the pursuit of disruptive innovation, and in essence voice a commitment of resources. However, the evidence captured by this investigation and the literature shows that embedded, deliberate, strategic processes and both path and resource dependencies, will significantly affect the actual strategies that can be delivered.

It has been shown that how managers and employees allocate their time and resources is a complex dynamic, which is diffused throughout all levels of the business. This makes it a difficult issue to manage, especially when trying to foster the pursuit of disruptive innovation. Analysis of the data captured by this investigation (as represented throughout the conceptual framework in chapter four), reveals seven common factors that contribute towards resource allocation processes, which are inappropriate for disruptive innovation (Figure 5-8). Each of these can be attributed, to a greater or lesser degree, to path dependencies, resource dependencies or issues regarding difficulties with strategic approaches.

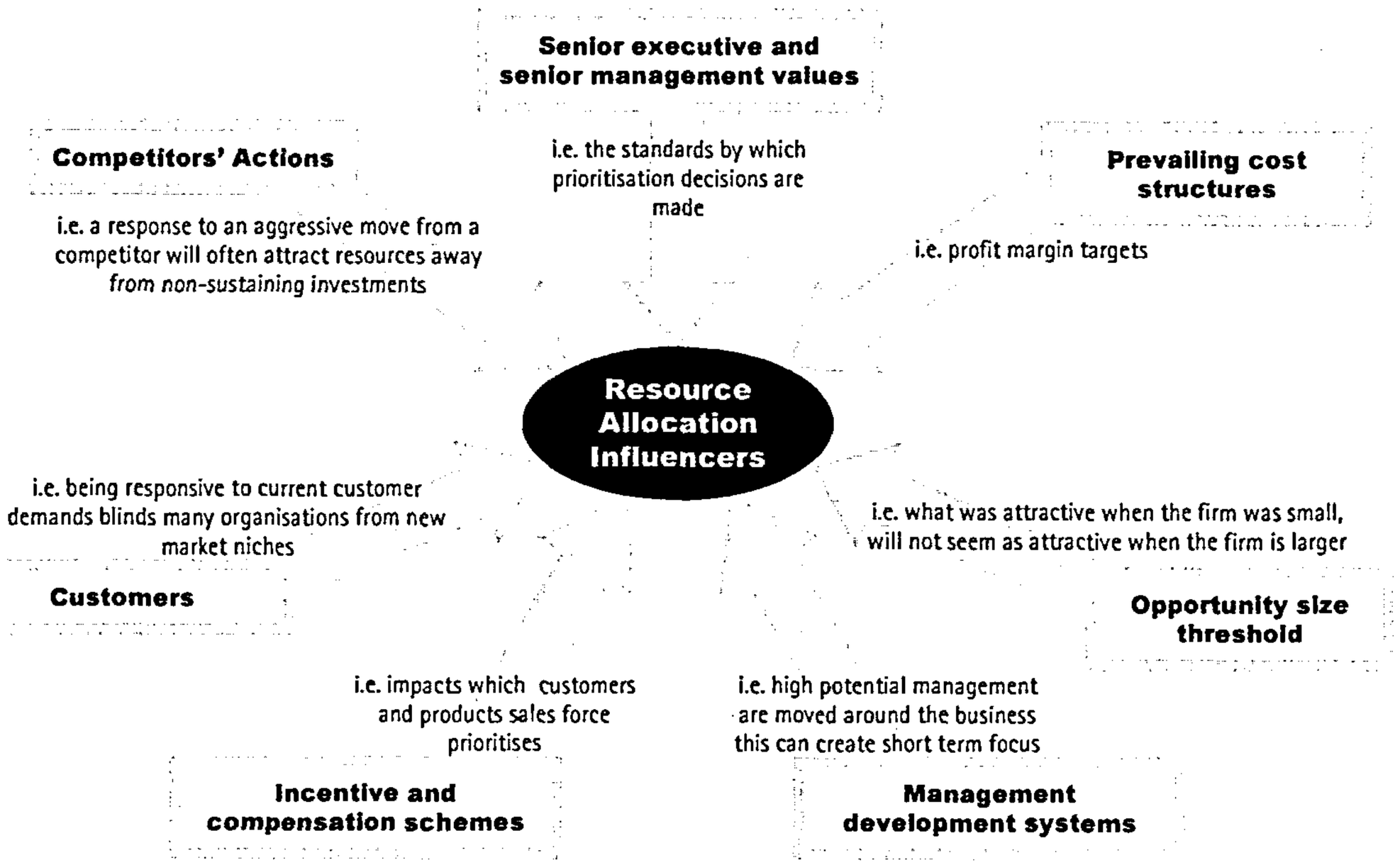


Figure 5-8: Influencers of the resource allocation processes that are inappropriate for disruptive innovation.

Due to the unexpectedly high content of value based influences (as opposed to mechanistic financial techniques), Figure 5-8, was also discussed with the research group from a systems thinking (Senge, 1990) and a cognitive mapping perspective (Hodgkinson, 2002; Swan, 1997). This approach has been referred to as "meta-triangulation" (Lewis and Grimes, 1999). The senior executive teams of each case organisation were observed to possess shared, deeply ingrained, assumptions and generalisations and even images of their organisations – what Swan (1997) refers to as cognitive maps. These assumptions, values and images appeared to influence how they and their management teams understand the world and how they take action. An awareness of these

shared images was virtually non-existent and an understanding of their impact was almost entirely missing – an observation also made by Hodgkinson (2002). Thus, despite espousing support for innovation that goes beyond incrementalism, the management teams were in possession of organisational images, which only supported a "more of the same" approach. Argyris (1982) notes that people do not always behave congruently with their espoused theories, they do however behave congruently with their "theories-in-use", or what Senge (1990) calls 'mental models'.

Senge's (1990) groundbreaking investigations into 'learning organisations' place significant responsibility upon the influence of mental models. He states that a management team's shared mental model is built upon the common elements of each individual's mental model, but also guided by the dominant top executives' perspectives. These shared views significantly affect the support that is given to the allocation of time and resources and the initiation of projects. This, consequently, explains why the senior management involved in this research perceived potentially disruptive innovations differently to the expert interviewees. Mental models have hugely powerful effects upon what we do because they affect what we see (Senge, 1990). "The inescapable conclusion is that the way we see our options can colour the decisions we make. [A notion that] spin doctors, pollsters and advertisers will not be surprised [to hear]" (Spinney, 2004:35)

Kaplan (1999) claims that when the members of an organisation are trained, to understand that technologies and processes have limited lifecycles, their personal values change and, by consequence, so do the mental models held by individuals and groups. As a consequence, organisational members, from the top to the bottom, change their behaviour; and both intended and actual support for innovation of a discontinuous nature increases. Figure 5-8 demonstrates the impact of personal values and the lack of understanding regarding the strategic importance of disruptive innovation. The mental models, upon which these values and knowledge are based, clearly contribute to the maintenance of inappropriate resource allocation routines, thus preserving the disparity between an organisation's strategic intent to pursue disruptive innovation and its actual strategy.

This subsection has shown when management practitioners attempt to pursue disruptive innovation, there is often a breakdown between resource approval and resource provision. Explanations for the existence of this breakdown have been offered from a number of perspectives but few insights have been provided for overcoming the resource allocation problem.

5.6.2.5 Operationalising resource allocation for disruptive innovation: Approaches and mechanisms to help management practitioners

The conceptual framework, developed in the first wave of this research, offers a number of insights for management who want to address the barrier of inappropriate resource allocation routines. In particular these include:

- The use of facilitative management tools that induce holistic thinking, whilst linking business and technology strategies, such as portfolio management (Cooper, Edgett and Kleinschmidt, 1999, 2000 and 2001; Luehrman, 1998) or technology roadmapping (Phaal et al., 2004; Groenveld, 1997; Rinne, 2004). [Chapter 4, Section 4.3.5.1]

- The simultaneous support of sustaining and disruptive innovation with flexible cost structures and targets, which allow attractive profits to be made at low price points or in small, emerging new-markets from the very beginning of a disruptive venture. [Chapter 4, Section 4.3.5.2]

- The use of staged seed funding capital that can be patient for growth [Chapter 4, Section 4.3.5.3].

- Management practices and resource allocation routines that support emergent strategy. [Chapter 4, Section 4.3.5.4]

- Avoiding financial targets that force potentially disruptive innovations to become too big too fast. [Chapter 4, Section 4.3.5.5]

- The abandonment of restrictive mental models with management teams well trained in the strategic importance of disruptive innovation. [chapter four, section 4.3.5.6]

5.6.3 Inappropriate resource allocation routines: A summary

Resource allocation routines have been identified to be a priority managerial focus area, to which the pursuit of potentially disruptive innovations is highly dependent. Section 5.6 provided an overview of relevant literature pertaining to this issue and offers insights into the data collected from the case study participants and the expert interviewees. Table 5-4 summarises the key themes and influences upon the context of resource allocation and the pursuit of disruptive innovation.

Literature Theme	Influencers		Authors
Decision making context	Structural Context:	- Management systems - Human resources - Physical resources	Bower (1970); Burgleman (1983); Leonard-Barton (1992); Ansoff (1965)
	Situational Context:	- Cultural systems - Individual and	Bower (1970); Burgleman et al. (1996); Leonard-Barton (1992)
	Resource allocation, not a one off event but an integral continuous process. Approval and commitment of resources is ongoing and cyclical in nature, based upon formal and informal feedback		Trott (1998); Christensen and Raynor (2003)
A continuous process	Resource allocation and strategy delivery, two sides of the same coin, both emergent and deliberate management approaches are important.		Christensen and Raynor (2003); Lynn et al. (1996); Kaplan (1999)
	New businesses require serial resources allocation - a continual process of formal proposals, approvals and the achievement of milestone operational targets		Noda and Bower (1996)
	Breakthrough projects require phased resource allocation - investments delivered in stages along the development process and throughout staged exploitation		Leifer et al. (2000); Rice et al (2002); O'Connor and Rice et al. (2001).
A breakdown between resource approval and resource provision	The innovation-to-organisation phenomena		Dougherty and Hardy (1996)
	The impact of 'resource dependencies'.		Burgelman and Sayles (1986); Pfeffer and Salancik (1978)
	The 'path dependence' of organisational development		Penrose (1995); Leonard-Barton (1992)
	The difficulties of simultaneously maintaining different strategy making and implementation processes for sustaining and disruptive innovations.		Brown (1991); Cooper et al., (2001); Christensen and Raynor (2003); Mintzberg et al. (1998)
	A lack of understanding regarding the strategic importance of disruptive change.		Kaplan (1999); Senge (1990); Christensen (1997)
	Prevailing mental models or cognitive maps may influence what managers do because they affect what they see.		Senge (1990); Hodgkinson, (2002); Swan, (1997); Festinger (1957); Festinger and Carlsmith (1959)
	Staged funding, with flexible cost structures and responsiveness to emergent evidence		Leifer et al. (2000); Rice et al (2002); O'Connor and Rice et al. (2001); Christensen and Raynor (2003)
Primary supportive management tools/approaches	Holistic decision making.		Cooper, Edgett and Kleinschmidt, (1999, 2000 and 2001); Phaal et al. (2004)
	The abandonment of restrictive mental models with awareness raising approaches, or a call to arms		Kaplan (1999); Ahuja and Lampert (2001); Senge (1990)

Table 5-4: A Summary of the resource allocation literature with respect to disruptive innovation

5.7 Identifying the needs of management practitioners

The final aim of this second wave of research activities was to solidify the emergent top priority focus area into a testable and verifiable proposition with the development of a research hypothesis. Accordingly, it was deemed necessary to investigate the needs of the case studies' management practitioners with respect to the resource allocation barrier.

The core themes of the literature review, pertaining to resource allocation, were presented to the participants from the case study organisations. During these presentations, workshop participants discussed the theories and constructs in relation to their own businesses and the pursuit of disruptive innovation. This section provides the reader with an overview of the analysis of these conversations.

5.7.1 Overcoming the resource allocation barrier: A specification for a management tool?

Much of the discussion with the case study participants involved addressing gaps in their organisation's formal resource allocation procedures. It was impossible to assess informal shadow systems (McMillan 2004; Stacey 2000) as they were considered too context specific for such a data collection approach. As gaps were identified, needs emerged and were categorised into clusters and themed accordingly. Five top management challenges emerged from the data analysis (Table 5-5):

The five top management challenges

1. Senior management need help to "see the whole innovation playing field – not just incrementalism", thus facilitating the identification and support of potentially disruptive opportunities. *[Team conclusion-Aggregation of Data-IS-3101]*
2. Senior management need help to "legitimise the allocation of resources" to potentially disruptive opportunities. *[Team conclusion-Aggregation of Data-IS-3102]*
3. Senior management want "best practice funding guidance" and want help with communicating this to the business, i.e. how to provide and protect resources to support the development of niche market offerings and how to create return on investment commitments that allow practitioners to be patient for growth but ensure their impatience for profitability. *[Team conclusion-Aggregation of Data-IS-3104]*
4. Senior management want to prevent projects with a dominant history or dominant people from taking resources away from disruptive opportunities. *[Team conclusion-Aggregation of Data-IS-3105]*

5. Senior management want help to achieve the above objectives whilst delivering best practice innovation management at all points in the new product/service development process (e.g. maximising benefits from investment into innovation, preventing project gridlock, delivery of strategic aims and a balanced focus between sustaining and potentially disruptive projects). *[Team conclusion-Aggregation of Data-IS-3105]*

Table 5-5: The top five most commonly cited needs of the management practitioners involved in this research with respect to overcoming inappropriate resource allocation routines

It was concluded that if the executive management teams of the four cases had tools or approaches, which could overcome these five challenges, then it could be possible to overcome the resource allocation barrier. It was thought by the research group, at the onset of investigating resource allocation routines, that an organisation's financial mechanisms (such as its cost structures, methods for calculating return on investments and probabilities of success etc.) would be the strongest of influencers over the resource allocation process. However, when probing the five challenges yet further, it was found that resource allocation routines, which are inappropriate for the pursuit of disruptive innovation, are not grounded in managements' ill equipped processes; instead, prevailing mental models (Senge, 1990; Hodgkinson, 2002) held the key.

5.7.2 Inappropriate Resource Allocation Routines: A problem of mind, not one of process

Spinney (2004) demonstrates that for centuries scientists have been trying to explain how people make decisions; she states that much of the focus until the middle of last century was concentrated upon rational thinking. However, "... researchers are starting to see how the choices we make are swayed by a complex range of factors such as emotions, social context and uncertainty, and how we weigh up the potential costs and benefits of alternative options before we make up our minds" (Spinney, 2004:32). This insight was held to be true during the identification of the above five challenges. It became clear that the influence of 'management values' had the most significant impact upon resource allocation decisions.

It was found that budgeting committees, production executives and marketing executives were reporting that they simply "felt uncomfortable" with allocating resources to concepts which were not valued by their traditional lead-customers. This was especially true for concepts which also lowered performance along traditional trajectories, whilst potentially offering lower gross margins. The consequence of being uncomfortable, in situations where potentially disruptive innovations are competing for resources, meant that actual strategies (the outcome of the resource allocation

process) become fixated upon the supply of incremental improvement and sustaining innovation in core product offerings. The data unequivocally demonstrated that the problem's roots were in the minds of the practitioners, within their very own cognitive processes; "... when we weigh up the cost and benefits of various courses of action, we do not just consider the material gains but also the social and emotional ones" (Spinney, 2004:33).

Senior participants from each case recounted times when they had been presented with an opportunity with disruptive potential. During these reports, the practitioners stated they had recognised and even felt the existence of an inconsistency between their current understanding of their organisation and the new opportunity. This inconsistency led to feelings of uneasiness and even resentment. They reported that the existence of such conflict created a cognitive driver to employ strategies to alleviate the dissonant feeling, which resulted in the rejection of the potentially disruptive opportunity (Figure 5-9). It appeared that numerous cognitive strategies were being employed to reduce the feelings of uneasiness that accompanied the potentially disruptive innovations. Furthermore, the use of these strategies could be linked to one root cause, the existence of restrictive 'mental models'.

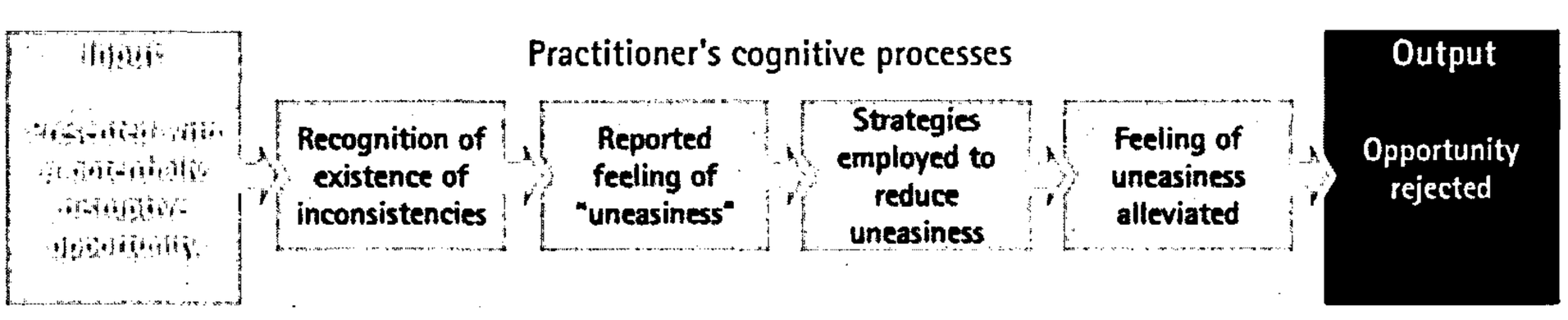


Figure 5-9: Potentially disruptive innovations, rejected because of a restrictive mind-set.

As previously explained, (section 5.6.2.4) people do not always behave congruently with their espoused theories, they do however behave congruently with their "theories-in-use" (Argyris, 1982), or what Senge (1990) calls prevailing mental models. Senge (1990) states "...that many of the best ideas never get put into practice... because they conflict with deeply held internal images of how the world works, [mental models are] images that limit us to familiar ways of thinking and acting." (p 174). Swan (1997) notes that cognitive maps (the term he uses for mental models) are the psychological tools that people use to construct and utilise knowledge. What makes them critical to the pursuit of potentially disruptive innovations is their role in determining and influencing the level of importance that is placed upon incoming information. For example, on encountering new stimulus and information a manager's prevailing mental models will determine whether this

information is registered as a high priority, a low priority, or whether it should be discarded (Harmon-Jones and Mills, 1999).

Using the term 'mental model' enables a better understanding of the management practitioners from the cases studies involved in this research, and their perception of inconsistencies between investment options. Furthermore, it can be used to explain why the management teams appear to employ disruptive innovation rejection strategies. Morgan (1993) notes mental models "... are always based on implicit images or metaphors that persuade us to see, understand, and manage situations in a particular way. Metaphors [and images] create insight. But they also distort. They have strengths. But they also have limitations. In creating ways of seeing, they create ways of not seeing." (p xxi). When presented with a choice between two options, Senge (1990) and Kiesler and Sproull (1992) observe that a person may anticipate or experience cognitive dissonance (Festinger, 1957) if one of the options does not fit with their established mental model(s). If this is the case, then he or she should be expected to react to minimise or completely avoid the probable or perceived discomfort. Festinger and Carlsmith (1959) called this response cognitive dissonance avoidance.

Thus, it would seem that the feelings of uneasiness that were reported to accompany a potentially disruptive innovation may occur because of the emergence of cognitive dissonance. For example, a prevailing mental model will skew perception. A management practitioner with a skewed perception may fail to see the benefits of a potentially disruptive opportunity because of the cognitive dissonance between the opportunity and his/her mental model. The cognitive dissonance generates unwanted conflicting emotion and the manager is driven to attach new values to the potentially disruptive idea, which differ from the actual values of the concept. The result is the rejection of idea because of its incongruence with the prevailing mental model(s), in an attempt to alleviate the presence of cognitive conflict.

Tripsas and Gavetti (2000) present the case of Polaroid; they show how the strong beliefs that were deeply diffused across the top management of the company were a primary reason for its failure to embrace disruptive digital approaches. Therefore, to tackle inappropriate resource allocation routines, and embrace the pursuit of disruptive innovation, it would appear that senior management may need tools or interventions that can help them to engage in cognitive change. However, attempts to change the cognitions of top managers can be highly dysfunctional for the organization. For example, Tushman and Romanelli (1985), Amburgey et al. (1993) and Sastry (1997) have provided evidence to demonstrate that strategic re-orientations, involving significant changes to strategic beliefs, entail substantial cost and are associated with high mortality rates.

Therefore, management tools or interventions must assist practitioners to understand the consequences of how their current mental models determine a fixed and narrow view of innovation as incrementalism. Managers need to be able to see how their current actions are driven by their cognitions *and* how these cognitions link to the disregarding or mismanagement of potentially disruptive innovations. When a person has a deeper understanding of a prevailing mental model they become freed to adapt or change it (Griffin, 1997, Harmon-Jones and Mills, 1999). In fact, Senge (1990) predicts that a "major breakthrough in the practice of organisational management in the future will be... the discipline of managing mental models – surfacing, testing and improving our internal *picture* of how the world works" (p170).

In an attempt to ratify the decision to focus upon the effects of prevailing mental models and management cognition, the data and insights from the expert interviews were cross examined and reassessed. It was found that these people and their teams actively fought against the temptation to succumb to disruptive innovation rejection strategies. Furthermore, of those that spoke of enabling or delivering breakthrough or *disruptive innovations*, there was a clear trend to display three 'disruptive-innovation-friendly' characteristics. The common link between the characteristics was not one of tangible process but one of mind-set:

i) The *ability* to see beyond the traditional - to see markets and products differently.

These practitioners were not constrained by prevailing trajectories of development, by tradition or by expectation. Unlike most members of the case study organisations, they actively tried to segment or to amalgamate technologies and markets in new ways to deliver new wealth creation – even if this involved changing the status quo. They held the mind-set that *disruptive change* was inevitable, so why not drive it instead of becoming its victim.

ii) Doggedness even arrogance.

Those that had been or were currently involved in the enabling or delivering of disruptive innovations, displayed a tenacity and single-mindedness that was not seen in the case study organisations. On the surface, this second characteristic could be viewed as negative or undesirable in many situations; in fact, it was reported that this was the main reason why 'disruptive innovators' were often not liked by change resistant employees. However, it seems that this persistence and self belief, which occasionally bordered on

arrogance, was a major enabler in the securing, borrowing or even illegitimate appropriation of resources for their disruptive ventures.

iii) Passion:

Linking the previous two characteristics was personal passion. Sometimes this was seen to be related to attempts to improve or maintain an image as an innovator, but mostly these people genuinely displayed passion for their change-supportive mind-set and their ability to innovate.

5.7.3 Summarising the need for focus

In sum, the final stages of the second wave of this research involved case study participants discussing resource allocation theories and constructs in relation to their own businesses and the pursuit of disruptive innovation. This has enabled the identification of the needs of management practitioners from average performing businesses. Initial focus was given to financial measures and tangible resource allocation mechanisms. However, the constraining effect of mental models, often referred to by the participants as the 'viewpoint of what innovation is', became the dominant focal point. Cross examination of the expert interview data also revealed that mind-set, not organisational process, was a key driver for allocating resources to the pursuit of disruptive innovation. These findings, therefore, were allowed to steer the remainder of this inquiry.

5.8 The development of a research focus

It was not possible to test the validity of the conceptual framework (developed in the first wave of the research) in its entirety, due to time and resource restrictions. Therefore, the second wave of this investigation used a staged methodology to identify critical focus areas from which corollaries can be drawn. The results of the investigation presented thus far, have led to a focus upon resource allocation routines that are inappropriate for the pursuit of potentially disruptive innovations. The investigation of this focus area (presented throughout Sections 5.6 and 5.7) has provided corroborating evidence for the findings presented within the conceptual framework that relate to resource allocation. Of particular relevance, is the need for holistic thinking and holistic decision making approaches [Chapter 4, Section 4.3.5.1] and the abandonment of restrictive mental models [Chapter 4, Section 4.3.1.4] with management teams well trained in the strategic importance of disruptive innovation [Chapter 4, Section 4.3.5.6].

It is believed that these finding allow the proposal of a research focus. For example, assuming that these findings were correct and generalisable, we would expect that specific circumstances or management actions could be proposed as highly important in attempts by senior management practitioners to overcome the resource allocation barrier. Table 5-6 highlights some of these such factors; although it is recognised that this list does not portray the complete or definitive picture, it can be used to create a focus for the final wave of the research.

A top management team, of an average performing organisation, could begin to overcome the resource allocation barrier if they...

... had an understanding of the importance of disruptive innovation.

... could map their priority innovation activities onto a holistic view of the entire innovation playing field (a view that includes areas for both sustaining and disruptive innovation).

... were facilitated to see how both mechanistic financing routines and a restrictive perception of innovation, constrain resources and generate a failure to support disruptive opportunities (thus providing a value based view of why innovation projects, with disruptive potential, have been killed in the past).

... were facilitated to see how it is possible to challenge existing restrictive funding routines and to allocate resources to potentially disruptive innovations.

Table 5-6: Factors important in overcoming the resource allocation barrier.

5.8.1 Creating focus for the final wave of this investigation

The final task of the second wave of this research was to create a research focus for wave three. It was decided to concentrate upon the prioritised focus area and to allow the emergent issues of importance to steer the research activities.

Antaki (1988) notes that often theories and models cannot be tested directly or in full. Instead, researchers derive corollaries from theories (e.g. if theory X is sound, we would expect to find Y - here Y is the corollary) and it is then possible formulate propositions or specifications about that corollary (Gibbons et al., 1994). Concordantly, it was decided that corollaries and specifications

could be derived from some of the key findings from the data and extant theory regarding the prioritised focus area. French and Bell (1990) illustrate that such corollaries and specifications can be reconstructed and summarised to form the specifications for management interventions. Thus an intervention was designed to introduce the conditions described in Table 5-5 to the case study sites A and B. "[I]nterventions are *sets of structured activities* in which selected organizational units (target groups or individuals) engage in a task or a sequence of tasks where the task goals are related directly or indirectly to organizational improvement. Interventions ... make things happen" (French and Bell, 1990:113).

Chapter 6 provides an overview of the management intervention that was, in effect, designed to further probe the prioritised focus area. The intervention was primarily workshop based, involving top management from both cases; it drew upon French and Bell's (1990) guidance on behavioural science interventions for organisational improvement.

5.9 Overview of findings in relation to research objectives: Wave II

The primary objective of this thesis is to *explore the nature and experience of management practitioners' pursuit of potentially disruptive innovations in average performing (or non-best-practice) businesses.* As shown in chapter three (the research methodology) the second wave of this research contributes to this objective by attempting to focus upon the satisfaction of the second sub-objective.

Sub-Objective 2:
To explore the emergent conceptual framework in order to identify focus areas of management action and management cognition to which the delivery of potentially disruptive innovations are highly dependent.

Thus, the second wave of this research was an exploration to uncover managerial focus areas to which the delivery of potentially disruptive innovations are highly dependent. Data were collected over an 8 month period using interviews, telephone conferences, email discussions and workshops. The analysis and the enfolding of literature revealed:

> Inappropriate resource allocation routines, a failure to address the strategic importance of disruptive innovation, an inability to identify or to generate disruptive foothold markets and traditional new product/service development routines are four highly important areas of management action and cognition that can prevent the pursuit of potentially disruptive innovations.

This finding directly supports conclusions that have been drawn in the literature by the likes of Dougherty and Hardy (1996), Liefer et al. (2000) and Christensen (1997). Although this cannot be asserted as a novel contribution to knowledge, it provides further support for extant literature and reassurance that the current research has delivered true-to-life findings. The identification of these four focus areas provided the executive managers involved in this study with concrete areas to which they could target their attention to initiate the pursuit of disruptive innovations. Furthermore, senior practitioners reported that a better understanding of the issues they face when pursuing potentially disruptive innovations leaves them feeling more enabled to tackle the challenge ahead.

Authors writing in the field of innovation have mentioned or described the impact of a multitude of factors that are important to the pursuit of disruptive innovation. "The real challenge is in building the capability within the firm so that it is prepared for, able to pick up on and proactively deal with innovation opportunities and threats created by emerging discontinuous conditions. In other words, to develop alternative routines for discontinuous innovation ('do different' routines) which can sit alongside those for steady state 'do better' innovation" (Bessant and Francis, 2004:135). Despite such a clear call for the development of new, academically robust and industrially relevant knowledge, the author is aware of only a few publications that have addressed the issue of "what should the management practitioner do differently tomorrow?". The analysis of data from this second wave of research and the enfolding of both expert interview data and literature, revealed the prioritisation of one of the focus areas as a major inhibitor faced by management practitioners who wish to pursue disruptive innovation:

> If a management team wants their average performing business to become an ambidextrous organisation – capable of pursuing both sustaining and disruptive innovations - an appraisal of their resource allocation routine should be a priority. Both the tangible and intangible processes that create inertia of support for sustaining innovation should be considered.

Thus, it is the contention of this thesis that managers who are wishing to pursue disruptive innovation should address inappropriate resource allocation routines as a matter of urgency. The findings of this chapter also demonstrate that in doing so managers should not only consider their physical resource allocation process but also the mental models and organisational inertia that support it.

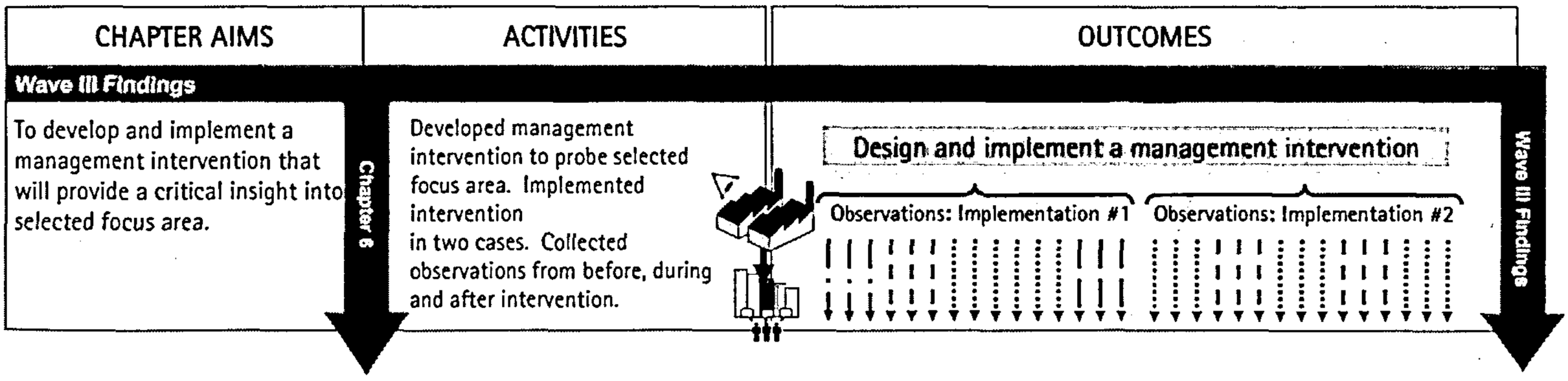
Investigation of this prioritised focus area led to the emergence of a research focus for the third wave of the investigation. Accordingly, the remainder of this thesis is mostly dedicated to presenting and discussing the findings of the third wave of research, which investigated inappropriate resource allocation routines. It is believed that these actions and results satisfy the second sub-objective.

The next chapter will further discuss the prioritised focus area with the view of overcoming the barriers caused by inappropriate resource allocation routines. It will then describe a management intervention that was designed and implemented to both probe the prioritised focus area further and to assist management practitioners to address the resource allocation routines that inhibit the pursuit of disruptive innovation.

6. Tackling a Significant Barrier to the Pursuit of Potentially Disruptive Innovations: Exploring and Describing Inappropriate Resource Allocation Routines

– The Findings from Wave III of the Investigation

This chapter is dedicated to presenting the results of the third wave of this inquiry, where research activities were concentrated upon investigating inappropriate resource allocation routines – the managerial focus area prioritised by industrial collaborators in the second wave of this research. An overview of the objectives is provided, followed by a description of a management intervention that was designed to probe the prioritised focus area. The intervention was implemented at two case study sites, the impact and results of which are presented in a within case format.



6.1 Introduction

6.1.1 Overview of primary objectives

The second wave of this research prioritised inappropriate resource allocation routines as a major focus area for the attention of management practitioners. Consequently, the third wave of this research has concentrated upon this focal point and the following four primary objectives were established:

1) To design a management intervention which can probe the management actions and cognitions involved inappropriate resource allocation routines. It should enable the

researcher to build new academic knowledge, whilst simultaneously aiming to improve the ability of the participating organisations to pursue potentially disruptive innovations.

2) To implement the intervention, *in situ*, with the top management teams of two industrial organisations (cases A and B).

3) To capture data throughout the intervention design and implementation process and through feedback sessions, which could be used to provide:

   a. A deeper understanding of case specific issues regarding resource allocation routines.

   b. Evidence to establish the industrial utility of the management intervention.

4) To conduct cross-case analyses of the data to provide further insights and generic conclusions regarding the prevailing gaps in knowledge, with respect to the resource allocation problem and the pursuit of disruptive innovation.

6.1.2 Overview of research methods

Wave III of the investigation was conducted over a 10 month period. Data were collected in three phases – 'intervention design', 'intervention implementation' and 'post intervention feedback and analysis' - from the following sources:

- 2 x pre-intervention semi-structured telephone interviews with cases A and B, plus numerous informal email and telephone conversations.
- 1 x two-day pre-intervention workshop with the senior management team of Case A (5 participants), including tour of site.
- 2 x pre-intervention telephone conferences with senior managers and engineers from Case B (4 participants).
- 1 x two-day intervention workshop, with the executive management team of Case A (5 participants).
- 1 x one-day intervention workshop, with senior divisional management team and senior engineers from Case B (16 participants).
- Instant post-intervention feedback from all participants.
- Feedback from independent observers of intervention at Case B

- 8 x post intervention questionnaires.
- 5 x post intervention interviews, with Cases A and B, at two months and six months after the intervention.
- Two feedback presentations delivered by representatives from the cases two months after the intervention.
- Multiple informal post intervention email and phone conversations.

The triangulation of data from these sources and the enfolding of literature revealed significant insights into the barrier to disruptive innovation that is caused by inappropriate resource allocation routines within cases A and B. A within case analysis is presented in this chapter and the results of the cross case analysis is presented and discussed in Chapter 7.

6.2 The development of a management intervention

6.2.1 Building a design specification

It was decided that a management intervention must be designed and implemented; the findings presented in Chapter 5 established the first specifications of the intervention:

> **Spec 1:** The management intervention should both probe the prioritised focus area, to garner further academic insights, and assist management practitioners to address the resource allocation routines that inhibit the pursuit of disruptive innovation.

> **Spec 2:** The intervention should account for the five management challenges identified in Chapter 5 (table 5-5)
>
> 1. Senior management need help to "see the whole innovation playing field – not just incrementalism", thus facilitating the identification and support of potentially disruptive opportunities. [Team conclusion-Aggregation of Data-IS-3101]
>
> 2. Senior management need help to "legitimise the allocation of resources" to potentially disruptive opportunities. [Team conclusion-Aggregation of Data-IS-3102]
>
> 3. Senior management want "best practice funding guidance" and want help with communicating this to the business, i.e. how to provide and protect resources to support the development of niche market offerings and how to create return on investment commitments that allow practitioners to be patient for growth but ensure their impatience for profitability. [Team conclusion-Aggregation of Data-IS-3104]
>
> 4. Senior management want to prevent projects with a dominant history or dominant people from taking resources away from disruptive opportunities. [Team conclusion-Aggregation of Data-IS-3105]

5. Senior management want help to achieve the above objectives whilst delivering best practice innovation management at all points in the new product/service development process (e.g. maximising benefits from investment into innovation, preventing project gridlock, delivery of strategic aims and a balanced focus between sustaining and potentially disruptive projects). [Team conclusion-Aggregation of Data-IS-3105]

Spec 3: The intervention should account for the circumstances and/or management actions proposed as highly important in attempts to overcome the resource allocation barrier as identified in Chapter 5 (table 5-6):

A top management team, of an average performing organisation, could begin to overcome the resource allocation barrier if they...

... had an understanding of the importance of disruptive innovation.

... could rigorously assess and map their priority innovation activities onto a holistic view of the entire innovation playing field (a view that includes areas for both sustaining and disruptive innovation).

... were facilitated to see how both mechanistic financing routines and a restrictive perception of innovation, constrain resources and generate a failure to support disruptive opportunities (thus providing a value based view of why innovation projects, with disruptive potential, have been killed in the past).

... were facilitated to see how it is possible to challenge existing restrictive funding routines and to allocate resources to potentially disruptive innovations.

The remainder of this subsection aims to demonstrate how the final details of the specification for the management intervention were developed based upon an understanding of the prioritised focus area and the aims of this research.

Observations of the restrictive impact of top management teams' shared mental models, motivated the development of an intervention in the form of a group process directed toward senior practitioners.

Spec 4: The intervention should be in the form of a group process directed towards the most senior practitioners of the participating organisations.

It was believed if senior executives and management could see how and why they inhibit the allocation of resources to disruptive innovation, then they would be in a more self aware position to tackle the problem. Thus, it was concluded if senior management teams are to fund disruptive innovation, they need to be able to see differently - an intervention was required to expose and explain the impact of prevailing mental models.

It is claimed that by seeing wholes we learn to foster health (Senge, 1990); the benefits of tools that help us to see information holistically are well documented (e.g. Pavio et al., 1968; Horn, 1998 and 2001; Maltz, 2000; Young, 2003). Moreover, the use of graphical approaches to the facilitation

of the data collection workshops in this research proved to be highly effective (see Young (2003) for a discussion of the benefits of graphical facilitation). Therefore, it was decided that a 'visual tool', which can deliver 'holistic understanding', should form a large component of an intervention to tackle the resource allocation problem.

> **Spec 5:** The intervention should use an holistic graphical approach to help the participants see and understand how their shared mental model(s) impact(s) their allocation of resources to innovation.

In their studies of radical change, Amis, Slack and Hinnings (2004) found that the propensity for radical organisational transition could be increased, if the most value-infused elements of the organisation were identified and manipulated. They provide evidence to show that it is these 'high-impact' areas that will have "an important functional and symbolic role in the effective functioning of an organization... [and] changing high-impact elements early in a change process is compelling because their symbolic value helps to convey the importance of the transition." (p18). Amis, Slack and Hinnings (2004) also found that changes to decision-making systems were the most important when it came to making radical transitions; however they state that changes to such areas were the most difficult to introduce. In fact, their research concludes that rapid, large-scale changes to the 'high-impact' elements of a business are ineffective and damaging to business objectives. Instead, they suggest that the instigators of change initiatives, which seek to deliver radical transitions, must first establish trust with the managers whose support is considered essential. It is then important to sensitively target the high-impact elements of the business with small, simple interventions that can generate powerful symbolic messages to influential organisational members. Thus, it was decided that the intervention that was to be developed for the third wave of this research had to encompass the following three issues:

> **Spec 6:** The intervention should
>
> - sensitively tackle the high-impact decision making routines regarding resource allocation;
> - involve the appropriate top management teams in a trusting relationship; and
> - be non-invasive and met by little resistance, whilst at the same time maximising a symbolic message to the organisation.

6.2.2 Deciding the upon the structural approach of the management intervention

Cooper (1999) states that senior executives who manage to optimise their innovation investments and define the 'right' new product strategy for their organisations are much like stock market

traders with portfolios of investments; they select the winning new product projects, achieve the ideal balance of projects, and they consequently will win in the long run. Yet, Arnold (2002) illustrates that many companies invest in R&D as an act of faith despite the risks and uncertainty (Figure 6-1).

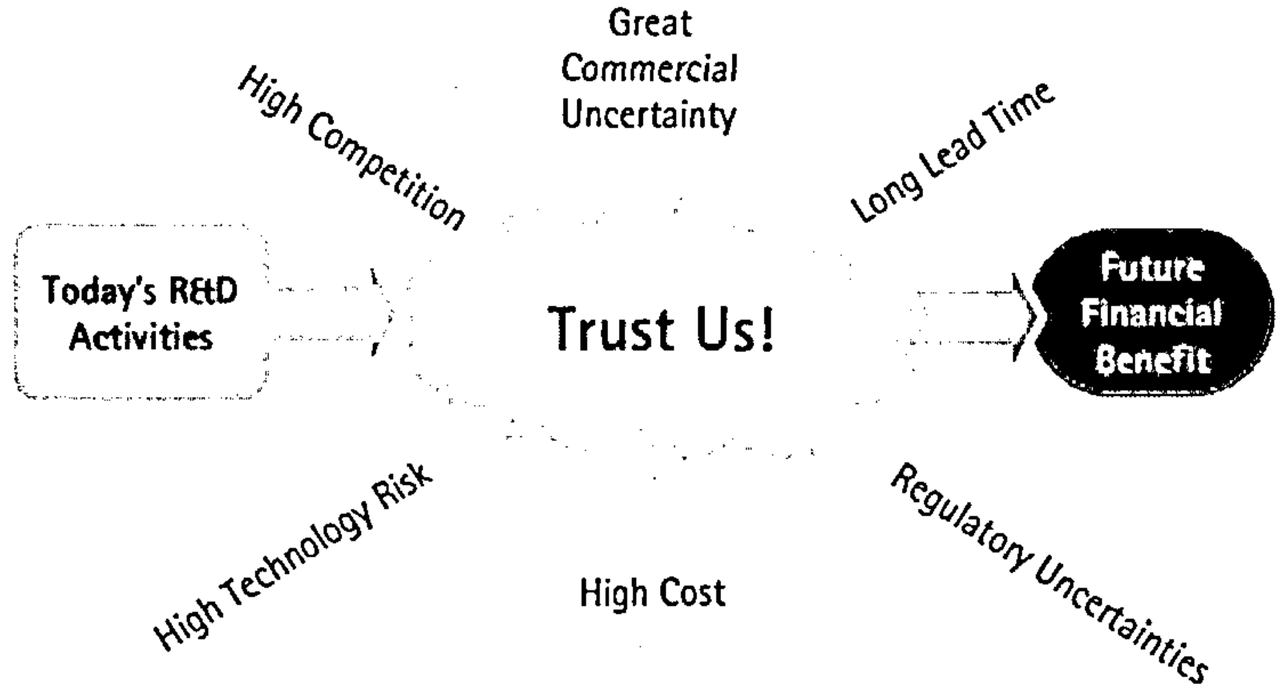


Figure 6-1: Investing in R&D as an act of faith (Arnold, 2002)

Arnold (2002) states that a vital question in product innovation management is: how should the corporation most effectively invest its R&D and new product resources? And he claims that *Portfolio Management* approaches aim to answer this question by delivering the allocation of resource to achieve corporate new product objectives. Effective portfolio management approaches have been shown to yield tremendous leverage for improving innovation productivity (Cooper et al., 2001) and the benefits from innovation investment (Cooper, 1999; Cooper et al., 2001; Figure 6-2).

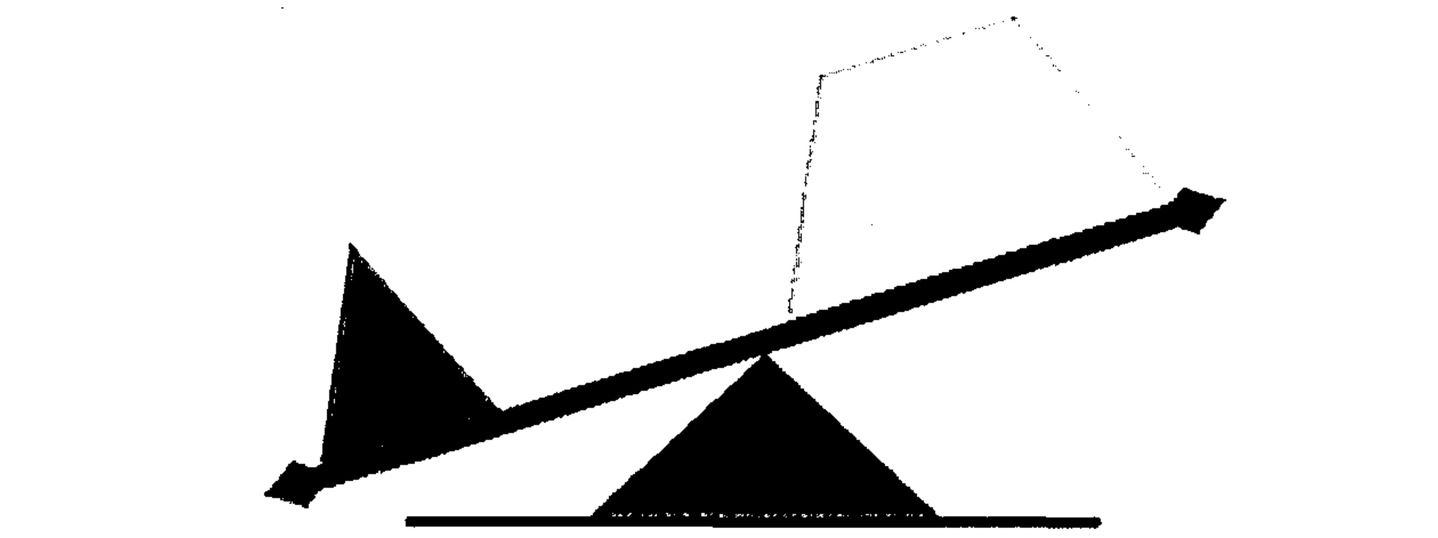


Figure 6-2: "Doing the right R&D vs. Doing the R&D right" (Arnold, 2002)

Portfolio management is a recognised and trusted management tool, utilised by senior management teams within many of the world's most innovative organisations (Cooper et al, 1999 and 2001). It uses graphical and visual techniques to deliver an holistic understanding of innovation activity. Luehrman (1998) and Hamel (2000) demonstrate that a portfolio of innovation activity should have three levels: (1) ideas/new concepts; (2) development projects or investigations and (3) projects at the point of pre-exploitation / new ventures pending launch. It is important to distinguish between ideas or investigations and new ventures within the portfolio because the most successful organisations will have a lot of small, quick losses whilst on their way to discovering true value adding initiatives (Burgelman and Sayles, 1986; Hamel, 2000). Hamel (2000) states that the logic of the portfolio management approach is based upon two principles: (1) to minimise risk by diversifying investments, and (2) "a business concept that gets killed, rather than scaled up, is not a dead loss... [it] produces learning, which, if captured and shared can help a company increase the odds that the next idea finds its mark" (p302). Moreover, portfolio management approaches have been shown to be relatively simple to initiate and implement, as they generally build upon existing processes and available management information (Cooper et al., 2001).

Discussions were held with the industrialists from the research group regarding seven resource allocation tools and approaches, one of which was portfolio management. It became apparent that the fact that portfolio management approaches were familiar, are well documented and openly trusted by world-class organisations was important. This wide scale endorsement of portfolio approaches led the management practitioners to report that they considered Portfolio Management to be more trustworthy and reliable than other less popularised approaches such as Technology Roadmapping (Phaal et al., 2004) or Real Options Valuations (Luehrman, 1998). Moreover, these approaches appeared to fulfil many of the intervention specifications identified thus far: an intervention for top management, a graphical holistic approach, and seemingly relatively simple to initiate, therefore, non-invasive.

However, questions remained before these approaches could be adopted and adapted: can they be used to enable managers to see differently - to expose restrictive mental models - and do they encompass enough of the resource allocation process?

Figure 6-3 demonstrates how portfolio management approaches can be mapped onto the resource allocation routines as described in Chapter 5 (section 5.6).

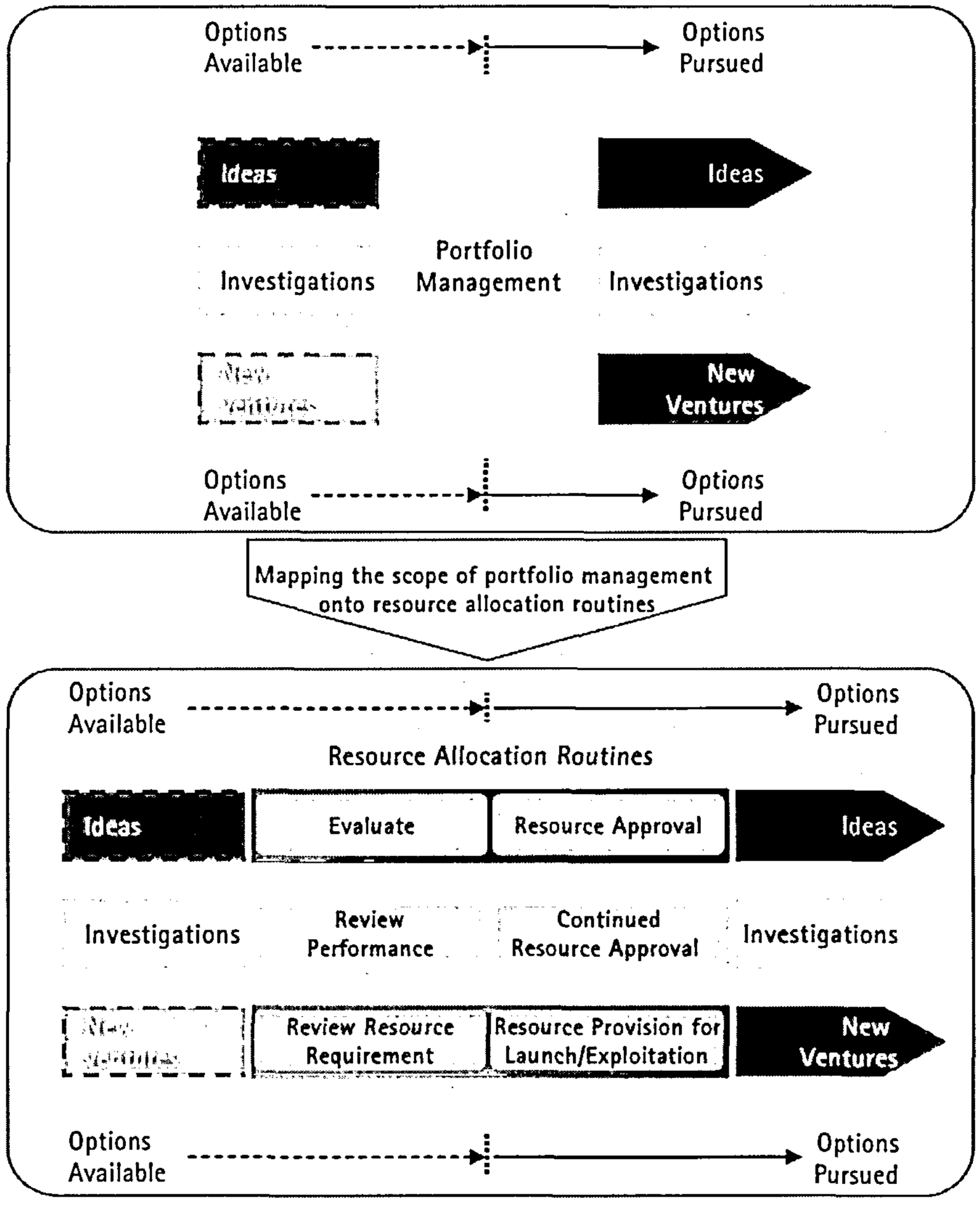


Figure 6-3: The scope of portfolio management tools

– assisting with resource allocation decisions throughout the innovation effort.

Cooper et al, (1999 and 2001) provide significant evidence to demonstrate that portfolio management approaches improve resource allocation decisions by an order of magnitude and that there are typically four goals when using these methods:

a) Value Maximisation – they can be used to maximise the commercial worth of all an organisations innovation investment options.

b) Balance – they illustrate how management decisions effect the balance of long vs. short term projects, low vs. high risk projects and maintenance vs. research projects.

c) Strategic Direction – they can help to ensure the portfolio reflects the organisations strategy.

d) Right Number of Projects – they can be used to avoid innovation pipeline gridlock.

Despite the clear advantages of using portfolio management techniques, there are few references to the pursuit of disruptive innovation in the publications of the leading edge portfolio management thinkers. Furthermore, Christensen (2003b) claimed in a recent on-line seminar that portfolio management methods, in their current form, have not been specifically developed to encourage the allocation of resources to potentially disruptive initiatives. Despite his claims to the contrary, nearly two-thirds of approximately 300 organisations, participating in this on-line conference on disruptive innovation, voted that portfolio approaches are the best way to deal with the unpredictability of innovation that moves beyond the steady state (Christensen, 2003). Thus it was decided that the characteristics of the portfolio management approach could be used to satisfy the specifications of the management intervention.

In sum, these findings were used to inspire the development of an intervention herein referred to as "Disruptive Portfolio Management (DPM)". Like other portfolio approaches, the DPM intervention was designed to provide an holistic understanding of innovation activity for improved resource allocation decisions. However, unlike other portfolio approaches, the DPM intervention was built upon the six specifications outlined above. Therefore, it integrates a state of the art understanding of disruptive innovation. It has been designed to enable participants to better understand why disruptive opportunities have not been easily financed in the past, and it was designed to help justify investment into potentially disruptive opportunities in the future. Furthermore, the use of a portfolio management approach enabled the continuation of the collaborative process. For example, adapting the portfolio management approach allows the author to gather data, present it in a new format and to discuss what the implications are. Alternatively, interventions such as Real Options Valuations would require the researcher to adopt a different approach: to gather data and then produce 'the answer'; this would have fit neither the researcher's personal beliefs nor the ethos of the research programme.

6.2.3 Intervening in the resource allocation process: An overview of the disruptive portfolio management intervention.

This subsection presents a concise overview of the 'disruptive portfolio management (DPM) intervention'; a more full description can be seen in Appendix 5. The DPM methodology was

implemented in four phases with a group of senior participants from both cases A and B (Figure 6-4). The participants were all executive or senior level management with responsibility for the development or implementation of innovation strategy and formal resource allocation.

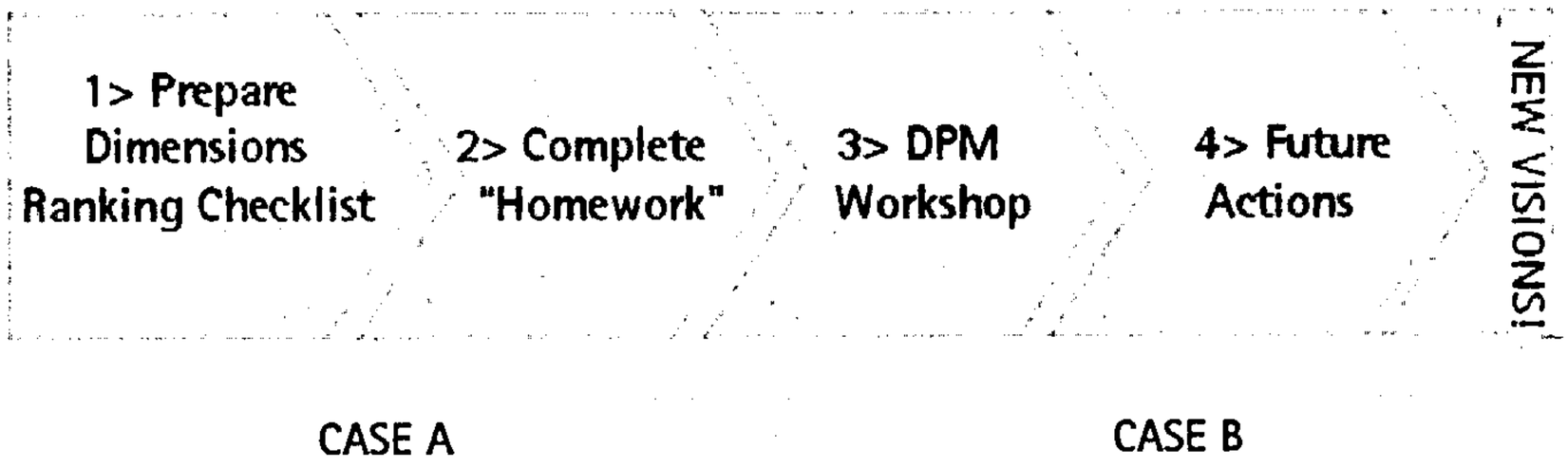


Figure 6-4: The DPM implementation: a process overview.

6.2.3.1 Phase One: Prepare Dimensions Ranking Checklists

The DPM intervention is essentially an assessment and analysis tool, founded upon a series of questionnaires called the dimensions ranking checklists (DRCs). The DRCs have two objectives:

1) To assess the organisation's priority innovation initiatives using a series of standard PM measures (e.g. market feasibility, technological feasibility, benefit to the organisations, fit with strategy, etc), plus a cluster of qualitative and quantitative measures focused upon disruptive innovation.

2) To gauge the impact of the initiatives under consideration (e.g. incremental, radical, discontinuous or potentially disruptive); whilst providing an analysis of each initiative's current stage of maturity, from early stage idea to advanced innovation project.

The aim of this stage was to ensure that the DRCs were ready for the interventions and that the industrialists' requirements had been taken into account. Pre-intervention discussions during day one led to some minor customisation of the DRC process before its implementation during day two. For example, the senior management team in Case A stated that they did not want to use the DPM

intervention to deeply consider financial measures (such as NPV, ROI etc), so the intensity of these questions was reduced.

6.2.3.2 Phase 2: Complete Homework

Two types of homework must be completed: Firstly the DRC assessments can be completed as 'homework' by the relevant project managers or R&D team. The assessors should select their organisation's top ten high priority innovation initiatives, in any stage of development, and a small selection of recently killed initiatives for assessment with the DRCs. Secondly, the author, as facilitator of the DPM intervention, gathers this data and plots it onto seven large scale portfolio maps or "Bubble Diagrams" (where projects are plotted on a variety of $1m^2$ maps using different parameters on the X and Y axis). Four of the maps are standard portfolio management views and three are designed to specifically account for disruptive innovation. The aim is to present to the senior management team a holistic graphical representation of their portfolio of priority innovation projects (Figure 6-5 illustrates how these appeared in the Case B intervention).

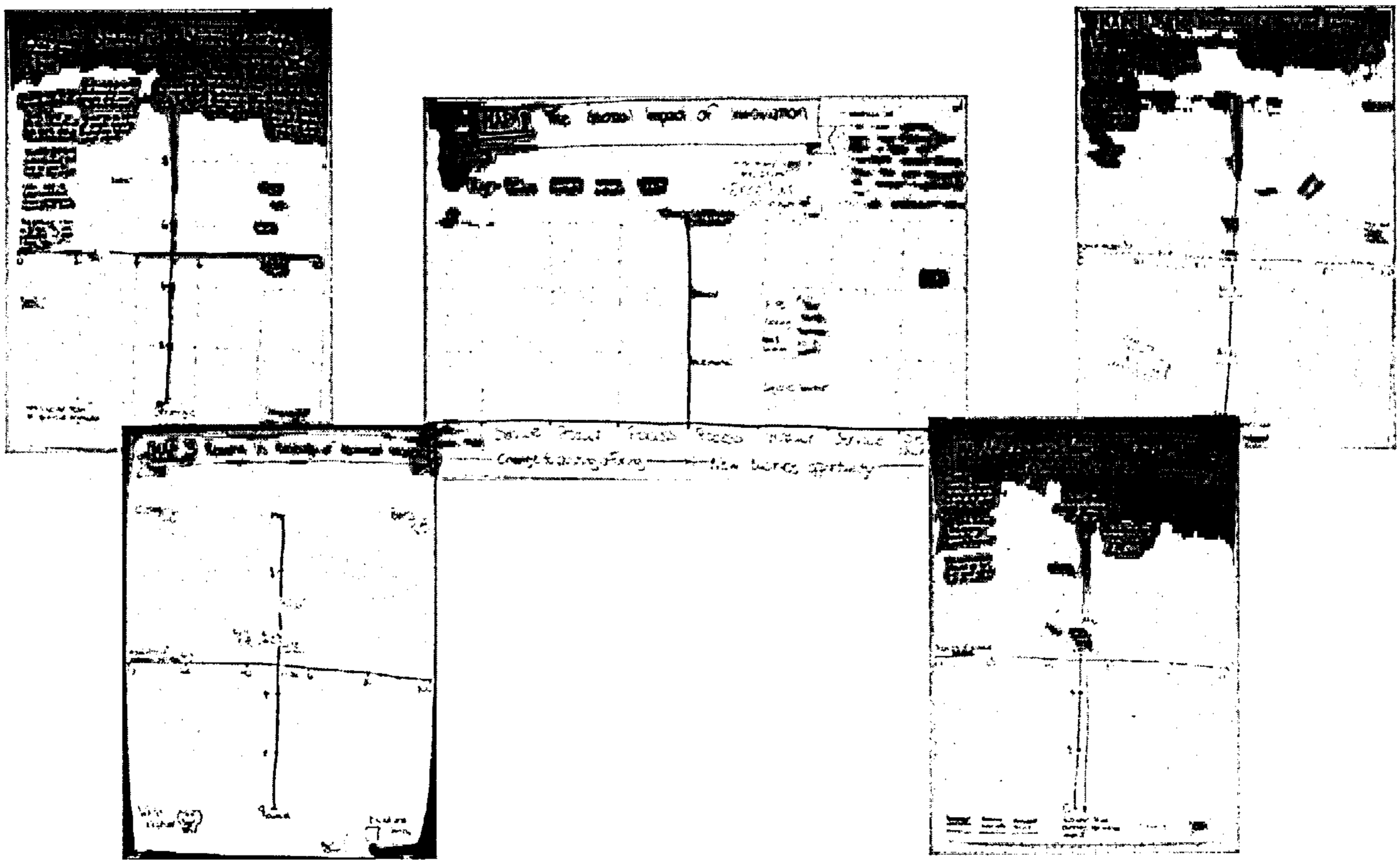


Figure 6-5: The DPM Intervention: Case B's key portfolio maps

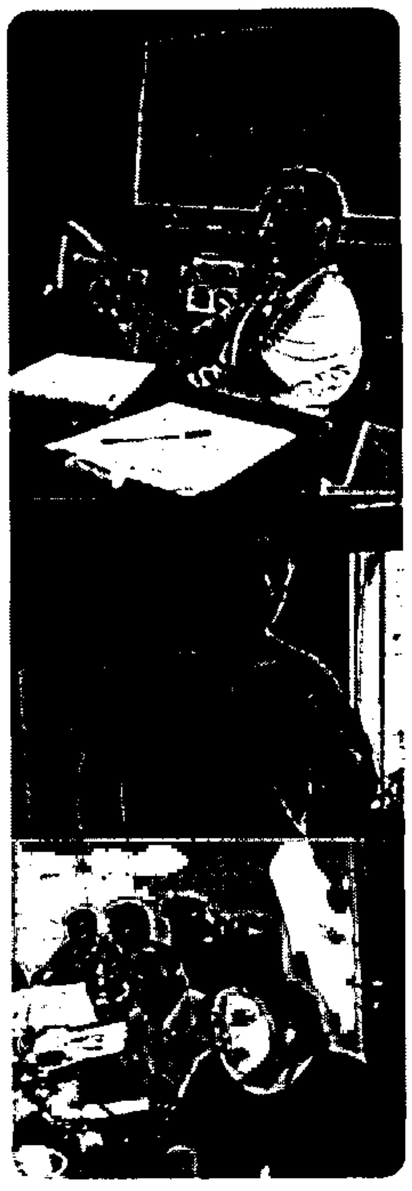


Figure 6-7: The DPM intervention: discussing future actions and new visions.

6.2.3.3 Phase 3: The DPM Workshop

The DPM methodology was designed to be implemented through an interactive workshop with senior management teams responsible for innovation strategy. The management team can choose a one or two day DPM workshop, which follows the agenda shown Appendix 5. The plotted portfolio maps are attached to the wall of the meeting room; the purpose of the workshop is two-fold:

(1) To allow the author, as facilitator, to introduce or re-emphasise the concept of disruptive innovation to the participants using a knowledge safari approach (a graphically based knowledge diffusion tool – see appendix 5).

(2) To allow the participants to be facilitated through an holistic analysis of the data from their portfolio maps. (Figure 6-6), in order assess how the prevailing approaches to innovation of innovation have influenced their resource allocation decisions.

6.2.3.4 Phase 4: Future Actions – New Visions

The final phase was designed to be driven very much by the participants of the intervention (Figure 6-7). Only when requested was guidance provided by the facilitator. The objective of this process is to use the richness of the preceding conversations in order to construct new visions to guide future resource allocation choices.

6.2.3.5 Closure of the DPM intervention:

Detailed case notes, of both formal and informal activities, were recorded throughout each intervention. Photographs were taken throughout the day to aid with documenting the events along with the graphically facilitated output from each group. Formal and informal

verbal feedback were recorded and questionnaires were completed by each participant (see Appendix 5). Finally, the author created a document that would, in effect, represent the minutes of the intervention process. These were distributed to the most senior manager present in each case.

Daneels (2004) states "I call for research to observe directly the processes within firms, particularly using field methods. Such research could track resource allocation to sustaining and disruptive technologies... and could detail decision making processes" (p252). It is hoped that the results presented in the preceding section and the discussion chapter that follows go some way to answering Daneels' call.

6.3 An overview of the management intervention's impact

The facilitated analysis of the holistic views created through the DPM interventions generated a number of interesting insights and decisions for both cases, which go beyond an assessment of innovation projects. It is believed that the outcome of the DPM process has contributed to an improved understanding of the pursuit of potentially disruptive innovations and the barrier of inappropriate resource allocation routines. The remainder of this subsection will present and discuss the results of the within case analyses. It will present for each case:

- an integrated overview of the observations made during the interventions,
- the main aggregated results of the initial feedback questionnaires (a full version of the questionnaire and its aggregated results can be seen in Appendix 6), and
- the results of the post intervention feedback after both two and six months

The findings from the cross-case analysis will be presented and discussed in the proceeding chapter.

6.3.1 Case A: the impact of the intervention

6.3.1.1 Key intervention observations, and the results of immediate post intervention feedback

Case A's priority innovation activities were plotted onto the portfolio maps following completion and analysis of the project dimensions ranking checklists (DCRs). Figures 6-8 and 6-9 are examples of the maps that were created; they suitably represent how Case A was allocating its time and resources to the 'innovation playing field'. These two maps proved to be the most influential in the generation of decisions and insights from the four that were used during the intervention.

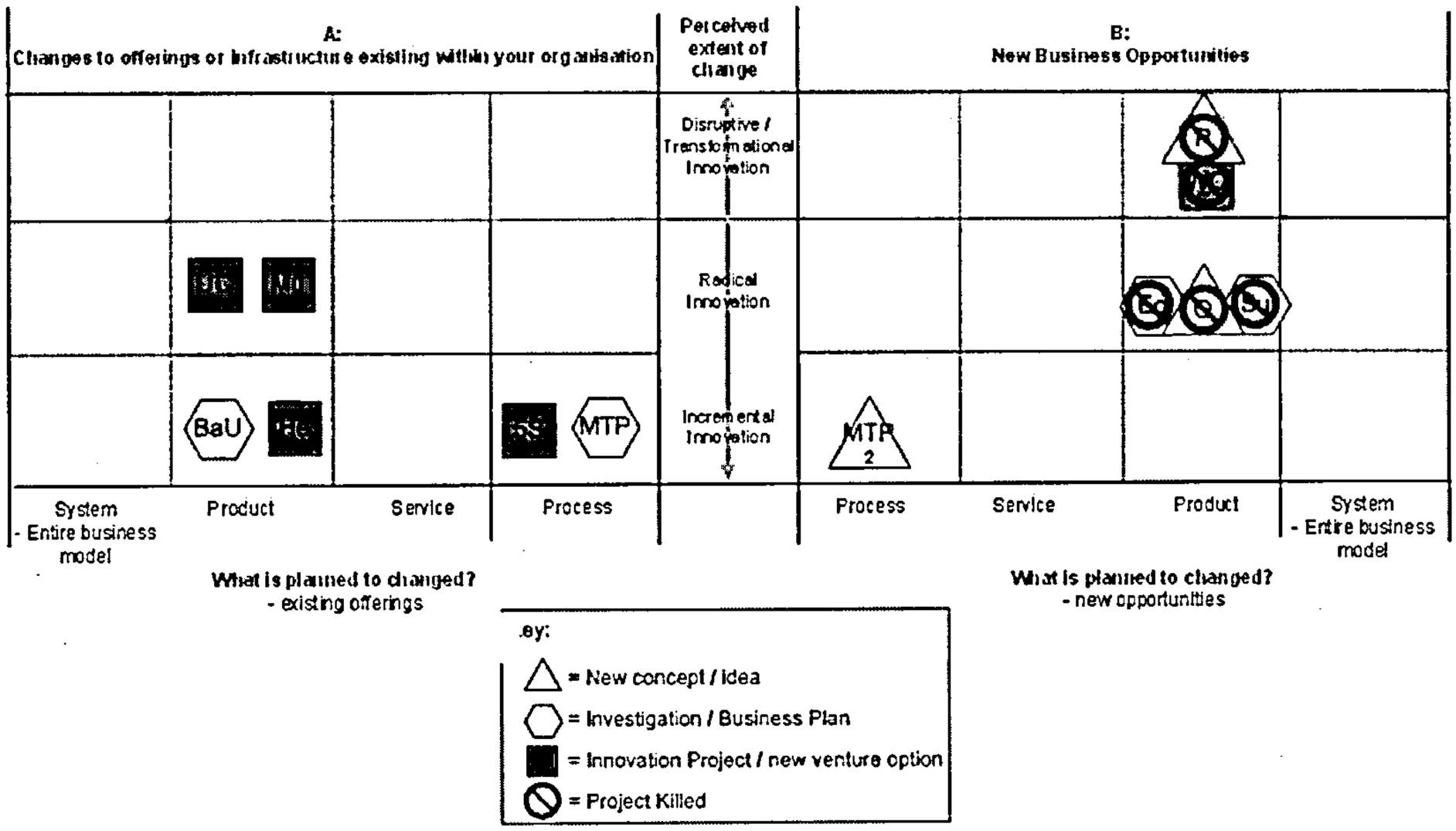


Figure 6-8: Case A's priority innovation activity.

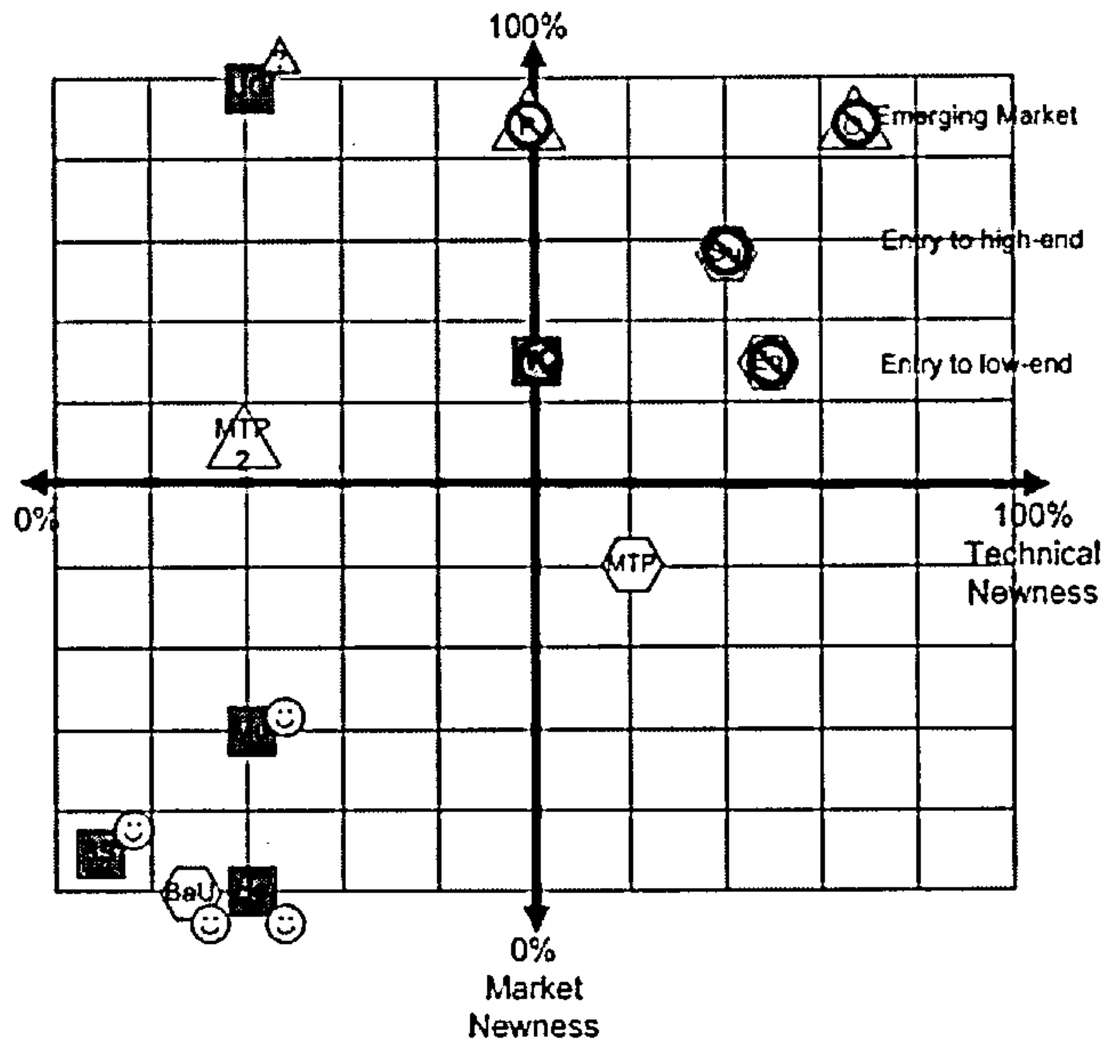


Figure 6-9: Case A's priority innovation activity viewed as a function of technical and market newness.

A number of early observations were made upon unveiling the portfolio maps containing Case A's top priority innovation initiatives:

- The diversity of Cases A's ideas and investigations, at first glance, looked promising. The maps show a spread of initiatives across familiar markets, current business activities and unfamiliar markets with new technologies.
- The promising diversity was quashed when recent project terminations, which had been made in response to competition, were factored into the holistic portfolio views. The terminations had enabled the management team to reallocate resources to accelerate the completion of projects contributing towards familiar core market products.
- The participants reported that they foresaw much of the project closure as they were experiencing serious issues regarding the integration of commercial information from unfamiliar markets. This was believed to be a major contributor to past project termination.
- It quickly became obvious that the participants preferred to work on highly controllable, predictable projects in familiar territories. In fact, the two initiatives that were rated to be potentially disruptive innovations were simply the Director General's pet projects.
- There was no process for gathering or attracting potentially disruptive ideas, neither was there an explicit or designated resource for experimenting with new concepts.
- The most senior people involved in the intervention expected every idea, development project and venture in their portfolio of top propriety initiatives to deliver significant returns. It was this expectation that appeared to maintain the organisation's focus upon conservative projects.

During the workshop process, which aimed to explore many of these initial observations, extensive field notes were taken, capturing the conversations, debates and analysis. A multitude of issues were raised; the remainder of this subsection presents the key insights generated and the key immediate effects of the intervention.

☐ *The impact of facing organisational decline:*

Case A's senior management team reported they believed that during a period of growth they could protect potentially disruptive innovations from the pressures of regular targets and stakeholders' demands. This would clearly provide potentially disruptive ventures with the space and time that they need to be nurtured from niche markets into disruptive, new-wealth-generating positions. However, at the onset of the intervention, Case A was facing significant organisational decline.

The early stages of the DPM process unveiled that organisational decline was keeping the team focused upon large scale market opportunities. In effect, they had unconsciously recognised that potentially disruptive innovations start in initially small niche markets, but the prevailing pressures had made these markets unattractive. Potentially disruptive innovations appeared to be inappropriate for contributing towards their immediate demands for growth. Thus, perhaps the most difficult issue for the senior management team of Case A to embrace was the suggestion, from the extant literature, that when trying to exploit a potentially disruptive innovation, practitioners should be patient for growth whilst being impatient for profitability".

Nevertheless, the DPM discussions enabled the team to understand that it must not forget about the potential of disruptive innovation, especially in the face of diminishing returns on investments into established core products (and even more so when these products are nearing the end of their lifecycles). For this reason, the senior management team quickly concluded that it must pursue a careful balance between delivering sustaining innovation and enabling disruptive innovation. It was hoped that the diminishing returns on incremental improvements to current offerings, could be abated, whilst knowledge about disruptive innovation could be adopted and exploited for future success.

☐ *The importance of contextualising the term disruptive innovation:*

The Director General of Case A stated during one of the pre-workshop interviews, that he alone was responsible for pushing new innovation boundaries and that the rest of the top management team failed to share both his enthusiasm and his motivation. In this regard, resistance was expected to the DPM intervention. However, a distinct tipping point was observed in the group's attentiveness and willingness to contribute to the workshop; this occurred following the completion of the Disruptive Innovation Knowledge Safari and the introduction of the organisation's portfolio maps of innovation activity. The participants embraced the notion and importance of disruptive innovation when they contextualised the term to their current situation. They used the terminology to refer to their current circumstances and realised that their business was, in fact, under attack by new

disruptive products from China. Furthermore, they could see they had neither a radical way of responding to the Chinese threat nor new revenue streams to pursue. The Director General also made the same observation:

> *"... I felt that some people 'saw the light', when they saw, for the first time, all their different project ideas visualised on structured meaningful maps, and it was clear WE are NOT being disruptive..." [A-Director General-IS-DPM-3244].*

It was this collective insight that appeared to generate commitment to the intervention and to the embracing of the pursuit of disruptive innovation.

☐ *Disruptive innovation rejection strategies – the impact of restrictive mental models:*

As stated earlier, in an attempt to refocus their innovation resources, in the face of competitive pressure, the top management team of Case A had made a decision to kill a number of initiatives, prior to the intervention. The results of this cull would appear to highlight a significant resource allocation bias - a desire to avoid allocating resources to projects situated within unfamiliar markets, especially those which involved technologies novel to the organisation. However, at the outset of the intervention, Case A's participants spoke of the decision to kill their projects in mechanistic terms regarding inability to meet financial targets, lack of technical feasibility and lack of commercial attractiveness.

Nonetheless, once a deeper understanding of disruptive innovation was delivered, conversation re-emerged regarding some of the previously terminated initiatives. This conversation, however, changed in nature and a deeper truth began to surface. The participants stated that termination decisions sometimes seemed to be based upon feelings and dogma, especially when the initiative was reported to be 'out-of-the-box'. The participants acknowledged their ownership of a narrow view of what constitutes valid innovation activity. It was also recognised that this view, and the beliefs and routines that held it in place, was largely responsible for killing many initiatives with new wealth and disruptive potential. A distinct change of language was noticed, in particular with the Director General. Once the team had acknowledged its narrow view of innovation, he stopped talking about projects "that didn't meet targets" and changed to speak of the "excuses we've made to kill projects". He became aware that he and his team had employed several disruptive innovation rejection strategies because of fear of the unknown, rather than objectively defined reasoning.

For example, analysis shows that the practitioners at Case A had become fixated onto a resource allocation habit (as illustrated by Figure 6-10) that had proved to be successful during the growth

of the business. All efforts were focused upon their main customers and new innovative ideas were assessed by two criteria: (1) "How much does it benefit our main customers?" and (2) "How much will it cost us?"

Perceived Value to Main-Customers	Cost: High	Cost: Low
High	*Analyse*	*Invest*
Low	*Ignore/Cut*	*Ignore*

Figure 6-10: A resource allocation habit at Case A.

High cost initiatives with a high perception of value to main customers were analysed for technical feasibility. If investments were made and benefits for key customers were later determined to be low, the project would be cut, as these initiatives were normally ignored. Likewise initiatives with low cost and low value to main customers were ignored in favour of projects with a low cost to the business but with a high benefit to main customers. For Case A, circumstances had changed but their resource allocation habits had not. Intense competition meant that price had become the benchmark for competition in their core market. Consequently, there were now few low cost innovations that could deliver high benefits. Furthermore, this narrow customer focus had excluded both the gathering of low-end disruptive propositions that might have been found in the bottom right corner of figure 6-10, and new customers for Case A competencies. The decisions not to pursue these avenues could be linked to the affects of disruptive innovation rejection strategies, which are discussed in greater depth in Chapter 7.

☐ *A decision to reposition a major innovation initiative – the first adoption of a disruptive strategy:*

From the insights garnered from the portfolio views, the senior management team decided they needed to invest resources differently into one of their major on-going initiatives. Prior to the intervention, this initiative (represented by the acronym UC in Figures 6-8 and 6-9) was considered to be a radical sustaining innovation. However, the team would now reposition the concept in an

emerging niche market and attempt to reconsider cost structures to allow the organisation to be patient for growth but impatient for profitability. Case A was about to embark on its first disruptive strategy.

☐ *A lack of early commercial consideration:*

The intervention unveiled that a lack of commercial confidence in unfamiliar markets was restricting Case A's innovation effort. The participants, in particular the Director General, decided that they must immediately address their lack of commercial thinking in early innovation activities; discussions commenced regarding training issues and a follow-up meeting was arranged.

☐ *A decision to kill a sustaining innovation project to provide resources to potentially disruptive innovations:*

The workshop allowed the participants to discuss their innovation activity holistically and in the context of the prevailing competitive environment. This facilitated a number of deep organisational insights. For example, during the workshop, the participants scheduled a follow-up meeting to discuss how one of their current high priority initiatives (a sustaining innovation in a core market with diminishing returns on investment), could be killed to make way for re-opening investigations into two previously closed potentially disruptive projects, which resided in peripheral markets. Case A had previously struggled to free resources from their fight with insurgent Chinese competition in their core market. The ability to open such a discussion, without it being quashed, was recognised by the participants to be a major breakthrough for Case A's management team. Furthermore, the indication that they were going to do this whilst attempting to enable potentially disruptive innovations in other markets was an unexpected and well received outcome of the DPM process.

☐ *The emergence of multi-stakeholder portfolio mapping:*

The Director General of Case A was surprised to see the low impact positioning of a key priority initiative, which he had assumed to be delivering high impact business benefits (represented by the acronym MTP in Figures 6-8 and 6-9). Consequently, he decided that he was going to take the "Reward Vs Probability of Technical Success" portfolio map to the major stakeholder in this initiative – an external materials advisor and supplier. He wanted to use the portfolio map as a tool to communicate his concerns and to drive a discussion to see if it was possible to improve the feasibility of plans and increase the benefits of the project.

☐ *The impact of subjectively selected innovation effort that purely responds to competitive threat:*

It became apparent that Case A had struggled to engage in rigorous, planned innovation effort. It was believed this was due to the restrictions that many SMEs face (e.g. their 'deal making' nature and limited management time and training) and was a major contributor to blockages in the resource allocation process. The head of quality and manufacturing believed they must adopt more rigorous project assessment and refrain from unplanned responses to their competitors' actions. He stated:

> *"Many of our decisions have been mainly based on 'feeling' this just isn't good enough any more. Today we have seen that it is not difficult to be objective, we must use these more analytical approaches" [A-Quality Manager-SD-DPM-3198].*

☐ *Emotional responses to challenging conventional behaviour:*

The consequence of challenging organisational routines, even when they were shown to limit organisations to incremental innovation, evoked significant emotional responses - particularly from Case A's Director General. The experience of emotional highs and lows were not explicitly stated by the participants in a formal context, either during or after the DPM intervention. However, their emergence was plainly evident and even 'joked' about during informal conversation following the workshop process. For example, there were emotive personal outbursts following the recognition that prevailing routines, which had delivered past success, had also killed potentially disruptive opportunities. There was a gradual but significant emergence of tension between the participants and the author, in his role as the facilitator, who was seen as responsible for surfacing these emotions. The Director General of Case A at one point suddenly shouted *"Are you telling me, Pete, that I'm running this business badly?"*, which almost led to the rejection of the process. However, when the participants acknowledged that it was their data which had produced the portfolio maps, and their insights which were challenging their current resource allocation approach, the tension was relieved, and the energy was refocused onto creating new visions of strategic intent for the future.

☐ *Overall impact assessment of the DPM intervention:*

Immediately following the workshop, the Case A participants unanimously voted the DPM intervention to be of significant benefit to their organisation (Figure 6-11). Particularly contributing to the feeling of success was the unanimous belief that that the objective of

'suggesting improvements to Case A's innovation strategy' had been 'mostly met' and that the following workshop objectives had been 'completely met':

- To introduce and familiarise the group with Case A's "innovation landscape".
- To allow the participants to understand the implications of their narrow project selection and the team's current resource allocation approach.
- To develop an understanding of how the senior management team's actions influence the innovation efforts of Case A.

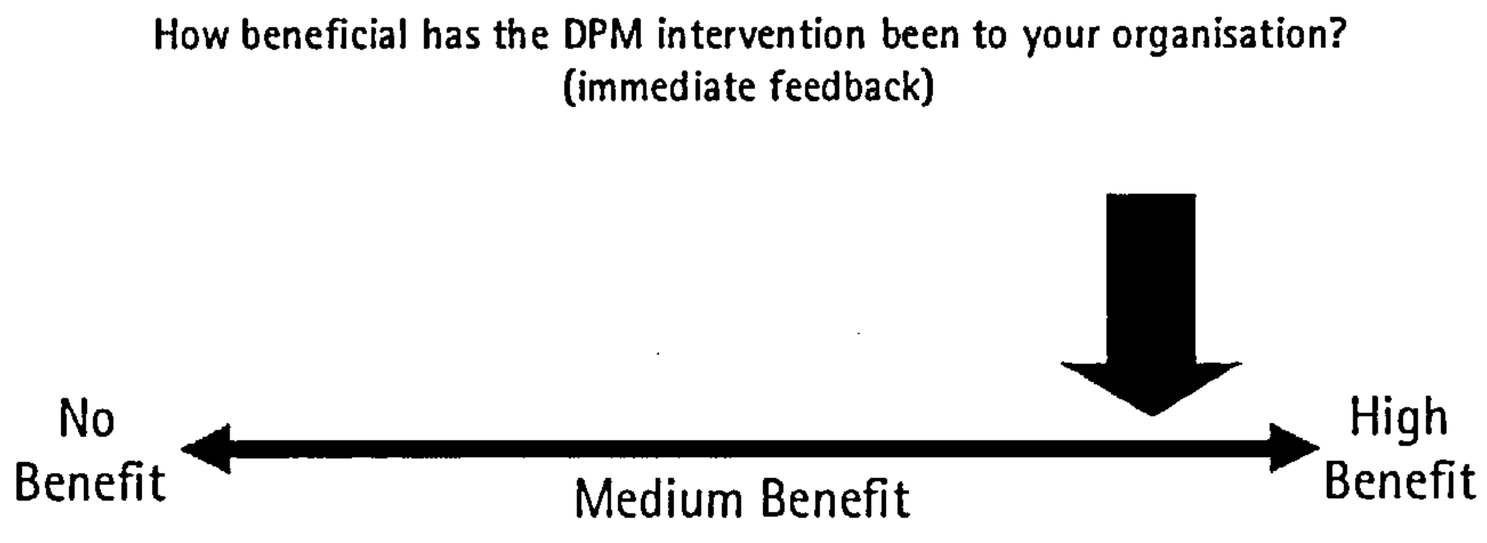


Figure 6-11: Case A's scalar rating assessment of the overall benefits delivered by the DPM methodology – completed immediately after the intervention,

☐ *The intervention delivered a clear, common and shared understanding of innovation activity:*

The overwhelming initial feedback from the top management team of Case A was that the DPM intervention had significantly enhanced their ability to articulate a clear, common and shared understanding of their innovation activity. It was reported that this understanding included a view of where the company is today and how it could seek to simultaneously pursue both sustaining and disruptive innovations in the future. It was this belief that contributed significantly to the perception of success.

6.3.1.2 Key feedback two months after intervention

☐ *Holistic tools help to deliver strategic action aligned to both sustaining and disruptive innovation:*

In a presentation, two months after the DPM intervention, the head of quality and manufacturing reported that the Case A participants had learned that strategic action is what comes out of the

resource allocation process. He stated that the DPM had helped them to realise a new strategic intent for the business, which they understood must be matched by resource provision. Furthermore, it was reported that they believed approaches that deliver an holistic understanding of innovation activity, such as the DPM methodology, could become the focal integrating device to achieve this aim and to carry forward their business strategy and planning process in the future.

☐ *Overall impact assessment of the DPM intervention:*

Despite the positive feedback above, Case A's participants unanimously voted that the DPM methodology had actually only delivered medium business benefits – this was not as high as they had previously stated (figure 6-12).

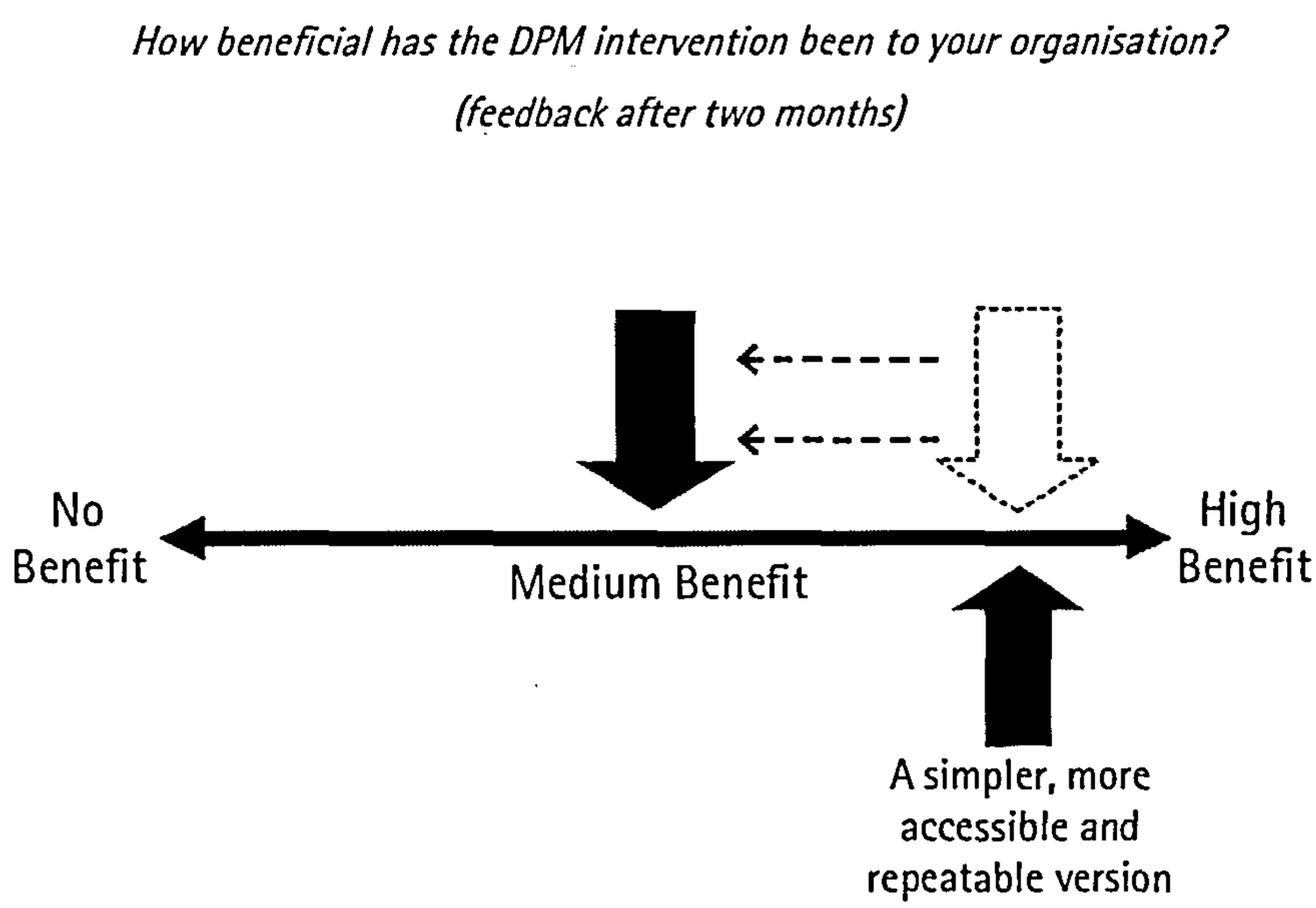


Figure 6-12: Case A's scalar rating assessment of the overall benefits delivered by the DPM methodology – completed two months after the intervention.

It was reported that intensifying competition in their core market had forced the management team to invest resources into sustaining innovations in order to protect jobs. Furthermore, when they tried to replicate part of the DPM process, without the support of the author, the methodology was deemed too complex and the benefits that were foreseen were not as easy to deliver as they had hoped.

☐ *Case A declares the need for an on-going DPM tool:*

The learning gained during the initial application of the DPM methodology, in Case A, had provided confidence in the benefits of the general approach – even two months after the intervention. The head of quality and manufacturing noted the key reason for this high level of confidence:

> *"The DPM workshop gave us a coherent view of our current innovation activity and helped us to justify resource allocation decisions..." [A-Quality Manager-IS-DPM-3400]*

They stated their desire to generate on-going benefits from the intervention and made clear their wish for a simplified process, to be customised to better suit their direct needs (Figure 5-23).

> *"[The DPM] helped to create a consensus of understanding and priorities that would have other wise been impossible to deliver within our management team – we need to keep this momentum, we need to tailor this process for us" [A-Director General-IS-DPM-3362].*

It was reported that such an on-going process would need to be integrated into Case A's review and planning cycles and enhance current information management systems.

☐ *The emergence of multi-stakeholder portfolio mapping:*

As reported in section 6.3.1.1, the Director General of Case A had planned to use the "Reward Vs Probability of Technical Success" portfolio map to initiate a conversation with a major external stakeholder. His aim was to improve the feasibility and the benefits of a major project. He reported two months later that this major technical programme had been cancelled following a number of conversations with the stakeholder, all of which had been kick-started by the use of the portfolio map.

☐ *A decision to reposition a major innovation initiative – the first adoption of a disruptive strategy:*

As reported in section 6.3.1.1, the top management team of Case A had planned to reposition one of their major on-going initiatives into a disruptive strategy. However, intensified competition in their core market led to a loss of a major contract, from their main customer, and despite the success of initial groundwork, it was reported that this forced the team to seek a sustaining role for their potentially disruptive initiative. Consequently, they were rushing the product to the mainstream core market in a hope that it would be well received and that they would not have to undergo major job losses. It was too early to see the results of this responsive strategy.

6.3.1.3 Key feedback six months after intervention

At the onset of this research in October 2001, the management team of Case A was aware of their over-reliance upon a large dominant customer. They had spent much of their time since then trying to address this situation in their core market, and the DPM intervention appeared to be responsible for re-establishing a focus on opening new revenue streams in unfamiliar markets. However, as mentioned in section 6.3.1.2, during the course of this investigation Case A suffered the loss of a major contract, from their main customer, in their core market. With no other major revenue streams, the loss of this contract meant that Case A could no-longer sustain a business and workforce of the size to which it had grown. Attempts to replace the lost revenues with a potentially disruptive innovation were in vain; not only was it too little too late but it would seem that customers in the mainstream market were not ready to take on this unusual offering. In February 2004, one month before the planned six month post intervention feedback, Case A terminated its involvement in this research and steps were taken to terminate prevailing operations.

☐ *A focus upon disruptive innovation rejection strategies:*

During this difficult time, the director general had remained in monthly contact. The main focus of the email and telephone conversations was disruptive innovation rejection strategies. He was clearly concerned about the effect of unseen influences upon the resource allocation process, to which both he and his team had become the victim. These conversations enhanced the data collected during the DPM intervention design and implementation and will be presented as a discussion in the next chapter.

6.3.2 Case B: the impact of the intervention

6.3.2.1 Key intervention observations, and the results of immediate post intervention feedback

Case B's priority innovation activities could be plotted onto the portfolio maps following completion and analysis of the project dimensions ranking checklists (DCRs), Figures 6-13 and 6-14 are examples of the maps that were created; they suitably represent how Case B was allocating its time and resources to the 'innovation playing field'. These two maps were two of four which proved to be the most influential in the generation of decisions and insights during the intervention.

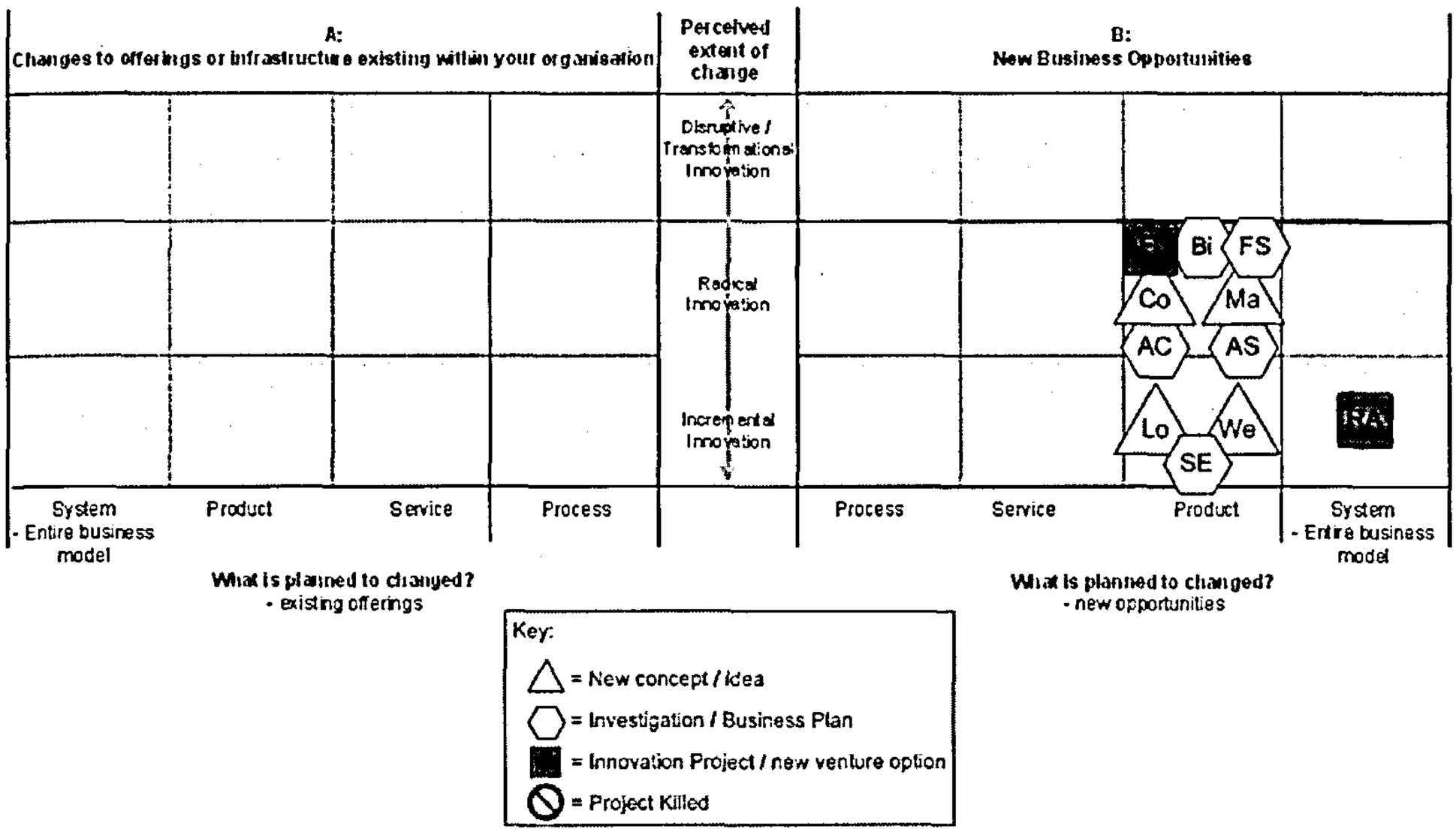


Figure 6-13: Case B's priority innovation activity.

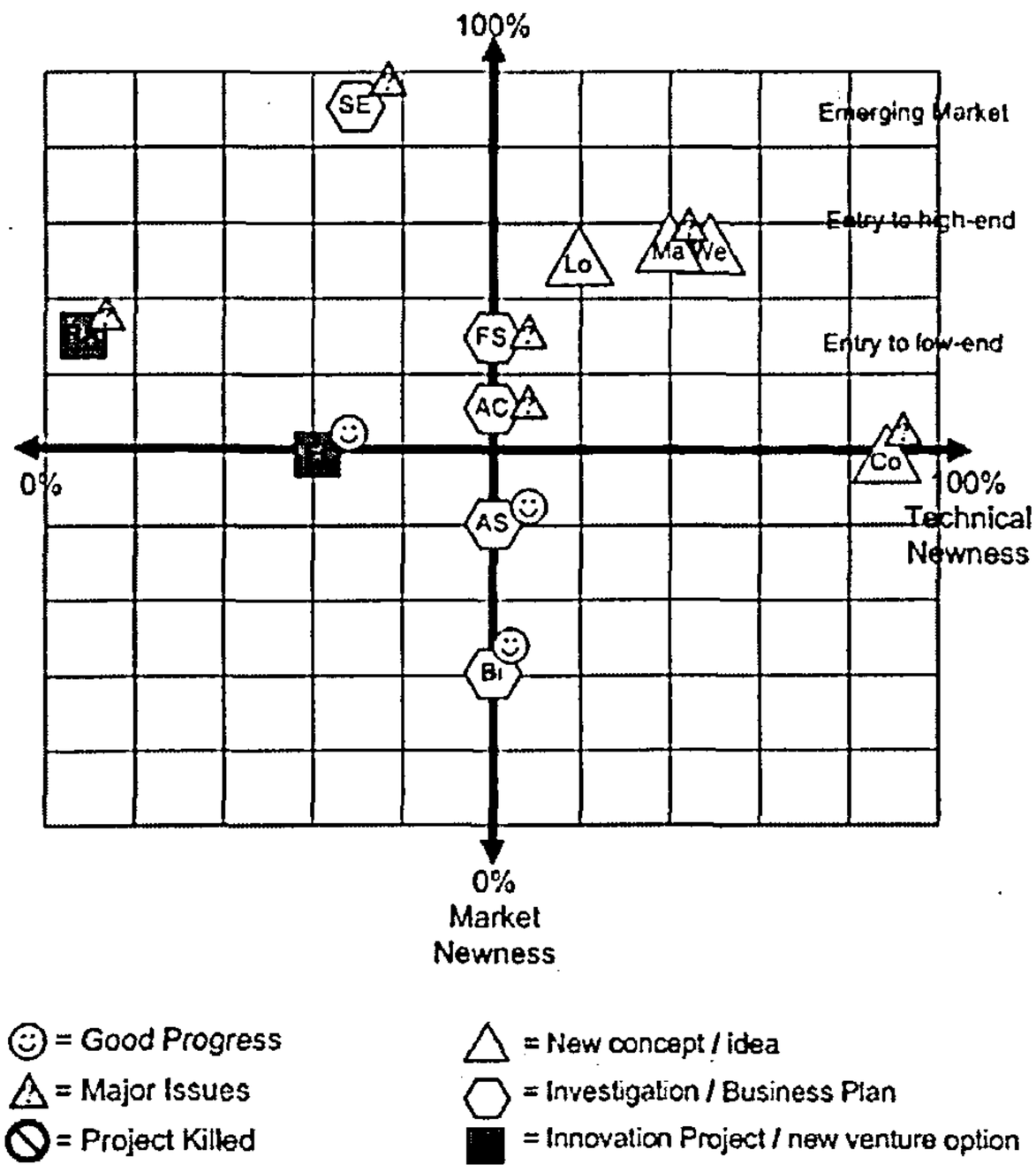


Figure 6-14: Case B's priority innovation activity viewed as a function of technical and market newness.

A number of early observations were made upon unveiling the portfolio maps containing Case B's top priority innovation initiatives:

- On seeing the portfolio map represented by Figure 6-13 for the first time, the first statement made by the head of the innovation team was:

> *"Do you use the saying 'you shouldn't keep all your eggs in one basket'? This picture looks rather worrying" [B-Head of Innovation Team-IS-DPM-3452].*

  Prior to the workshop, he had reported that he believed the team's priority innovation initiatives were "a diverse group of future options".

- The most senior participants of the DPM workshop raised the immediate concern that the innovation team's priority focus had been given completely to opportunities that lie outside the core of existing activities. There was concern that the increased competition, faced by Case B's core business propositions, was not being alleviated by the introduction of radical or potentially disruptive opportunities.

- The projects represented by the acronyms 'SE' and 'RA' in Figures 6-13 and 6-14 were rated by the project managers to be potentially disruptive innovations. However, as English was not their mother tongue, language issues has led to confusion and meant that these initiatives were quickly repositioned by the senior management team to their positions shown in Figure 6-13.

- Despite the focus upon developing new business in unfamiliar markets, Case B was exhibiting major problems with commercialisation issues within unfamiliar territories. It was initially reported that there was perhaps not enough commercial consideration in the early stages of the innovation process.

- It was apparent that executive management were expecting every priority initiative to yield significant returns for Case B. This expectation was quickly noticed to have a draining effect upon the portfolio. Stakeholders in the innovation process only liked to present opportunities with a high certainty over the outcome, and were reluctant to reveal ideas for potentially disruptive innovations.

- It was reported almost instantly that Case B had no explicit or designated resource for experimenting with new 'out-of-the-box' ideas. Thus it was difficult to attract or gather potentially disruptive opportunities.

During the workshop process, which aimed to explore many of these initial observations, extensive field notes were taken, capturing the conversations, debates and analysis. A multitude of issues were raised; the remainder of this subsection presents the key insights generated and the key immediate effects of the intervention.

☐ *Building consensus:*

It was observed that the participants were almost overjoyed by the fact that they did not have to engage in long discussions regarding the impact or importance of the individual projects. The use of a standard checklist that assessed and ranked the various critical dimensions of each initiative, which was supported by the head of the innovation team, had given the participants confidence in the data that was represented by the portfolio maps. The holistic views allowed some initial project movement but consensus was reported to be delivered more quickly than ever before.

☐ *A bias against small experiments and the credibility of internal entrepreneurs:*

It became clear that Case B's executive management team, and the management team of the division with which this research was conducted, maintained a bias against small experiments. To get noticed or to be considered as delivering a true contribution, it appeared that employees had to be seen working on large prominent projects. This does not support the facilitators of disruptive innovation discussed in the previous chapters, such as win small, win early and win often. During a coffee break in the intervention, two senior engineers reported that the credibility of those in the innovation process was linked more to the size and budget of the project, rather than the results that it was delivering. Later, and again in an informal context, these same two engineers explained that they were working on small private projects, which they had not reported to the top management team. Following a discussion, it was clear that both initiatives had significant disruptive potential, yet worryingly, from Case B's perspective, neither engineer wanted to announce their discoveries to the corporate powers. They believed that their credibility would be at stake. Instead, they were both considering establishing their own businesses to pursue their initiatives in their own time. Clearly, Case B's bias toward large experiments not only flies in the face of theory on disruptive innovation, but it was forcing the innovation process to haemorrhage its potentially disruptive innovations.

☐ *An arrogance that "business as usual" will protect core markets*:

After initial probing it became clear that past success, with world beating technologies, underpinned many of the participants' belief that Case B could not be disrupted in their current

mainstream markets. Therefore, despite preliminary evidence of 'technology over-supply' in several core product categories, Case B's top priority innovation initiatives were focused upon new business creation.

☐ *Disruptive innovation rejection strategies – the impact of restrictive mental models:*

Similarly to Case A, Case B's participants spoke of the decision to kill projects in mechanistic terms regarding inability to meet financial targets, lack of technical feasibility and lack of commercial attractiveness. However, the conversation changed in nature and a deeper truth began to surface once a deeper understanding of disruptive innovation was delivered. For example, the bias against small experiments, as presented above, was discussed in the context of the pursuit of disruptive innovation. Consequently, many of the participants stated that termination decisions were clearly based upon prevailing dogma, especially when the initiative was considered to be 'out-of-the-box'.

Despite intended strategic commitment to being a world class innovator, the participants slowly acknowledged their ownership of a narrow view of what constitutes valid innovation activity. Once it was recognised that this view was restricting the pursuit innovation, the participants began to admit (in retrospect and in trust) to many circumstances where they rejected potentially disruptive opportunities, in favour of sustaining innovation. It was clear that a number of disruptive innovation rejection strategies were being employed both at a conscious and unconscious level. The divisional Director of R&D summarised this finding:

> *"These holistic portfolio maps presented us with information that was previously unseen" [B-Director of R&D-OE-DPM-3487].*

Decisions to reject or kill projects became the focus of a great deal of discussion and debate; an analysis of this debate is presented in Chapter 7.

☐ *Creating new strategic intent:*

When Case B's most senior participants recognised that they had been unintentionally employing disruptive innovation rejection strategies a new priority objective emerged: 'to build a new vision and focus for the future of innovation activity which includes disruptive innovation'. Significant time was spent discussing how they could avoid falling into the trap of rejecting potentially disruptive innovations again in the future. These discussions led the head of the innovation team to facilitate and literally create a new intended strategy. He listened to the group's commentary, pushed for deeper insights and then, using a marker pen, he physically circled areas of the portfolio maps, which he believed must become Case B's targets for the future. It was from these areas which the team and the author believed potentially disruptive innovation were more likely to

emerge. This was considered to be one of the most powerful moments in the DPM workshop, as it led to the development of new future focus areas and generated consensus and support, from the entire group, regarding how resources should be allocated. When asked for feedback at the close of the intervention the head of the innovation team stated:

> *"... it's [the DPM methodology] enabled us to touch the very basic assumptions of our business... now lets get disruptive" [B-Head of Innovation Team-IS-DPM-3611].*

☐ *The effect of facing "unusual organisational objectives":*

The DPM intervention helped to unveil Case B's commitment to an unwritten, implicit company objective – the desire to create more jobs for Israeli citizens. The management team could clearly see that an investment into a large-scale project was more likely to rapidly deliver higher-levels of new job creation. Thus, this unanticipated and unusual organisational objective became difficult to reconcile with the initially low levels of job creation in small or emergent niche markets in which potentially disruptive innovations tend to begin their existence. Eventually, the participants' attention was focused upon the key feature of disruptive innovation that related to their implicit organisational objective: disruptive innovation is a source of new-growth markets and new-wealth creation. Thus the potential for long-term benefits allowed the participants to reconcile their unusual organisational objective with investments into small or emergent niche markets.

☐ *The importance of an holistic view of innovation activity – improving the quality of discussion:*

The participants reported that they believed the holistic view of innovation activity had allowed the management team to broaden the discussion of innovation activity to include disruptive innovation. Furthermore, they believed that the dialogue in general had improved in quality because discussions were less rambling than most previous R&D meetings, and actions were easier to agree and communicate. The holistic views prevented the most organisationally well know project from overshadowing the discussion Moreover, the main contribution that the holistic views and the DPM process gave to improving the quality of discussion was reported to be the prevention of the most senior person from dominating the whole meeting.

☐ *The importance of an holistic view of innovation activity – tackling mental models:*

The participants reported that they believed the DPM intervention had provided them with a holistic view of the entire innovation playing field and how they were performing in relation to all

the differing approaches to innovation. They continued to announce that when armed with an holistic understanding of innovation activity they found it easier to challenge prevailing mental models and to legitimise the pursuit of disruptive innovation. It was also reported that the use of the holistic portfolio maps would allow them to ring-fence resources for potentially disruptive opportunities.

☐ *A reduced perception of risk facilitates the pursuit of disruptive innovation:*

At the onset of the intervention, it was reported that potentially disruptive opportunities were perceived to be high risk ventures. However, it was clear that a major reason for this perception was the focus upon large scale projects that dominated the R&D activities of Case B. Wheelwright and Clark (1992) note it is quite right for management practitioners to consider mass investment into an unproven technology or unproven business concept as a high risk strategy. However, the participants reported that they believed the DPM intervention had provided them with a better understanding of the issues relating to the phenomenon of disruptive innovation (in particular, the need for probe and learn approaches and seed and staged funding processes). Armed with this information and the holistic views of innovation activity, the most senior participants reported their perception of risk in relation to potentially disruptive innovation had been reduced. It appears that it was this reduced perception of risk that enabled the group to address the preclusion of potentially disruptive opportunities from their innovation activity.

☐ *Overall impact assessment of the DPM intervention:*

Immediately following the workshop, the majority of Case B's participants voted that the DPM intervention had been of high benefit to their organisation and had contributed to their professional development (Figure 6-15).

Particularly contributing to the feeling of success was the unanimous belief that that the objective of suggesting improvements to Case B's innovation strategy had been 'completely met', as had the following additional workshop objectives:

- To probe each of the important portfolio views for the deeper implications of Case B's current resource allocation approach.
- To develop an understanding of how the senior management team's actions influence the innovation efforts of Case B (particularly the surfacing of restrictive mental models).
- To understand how an holistic view of innovation activity can be used to develop a new vision of strategic intent for the future.

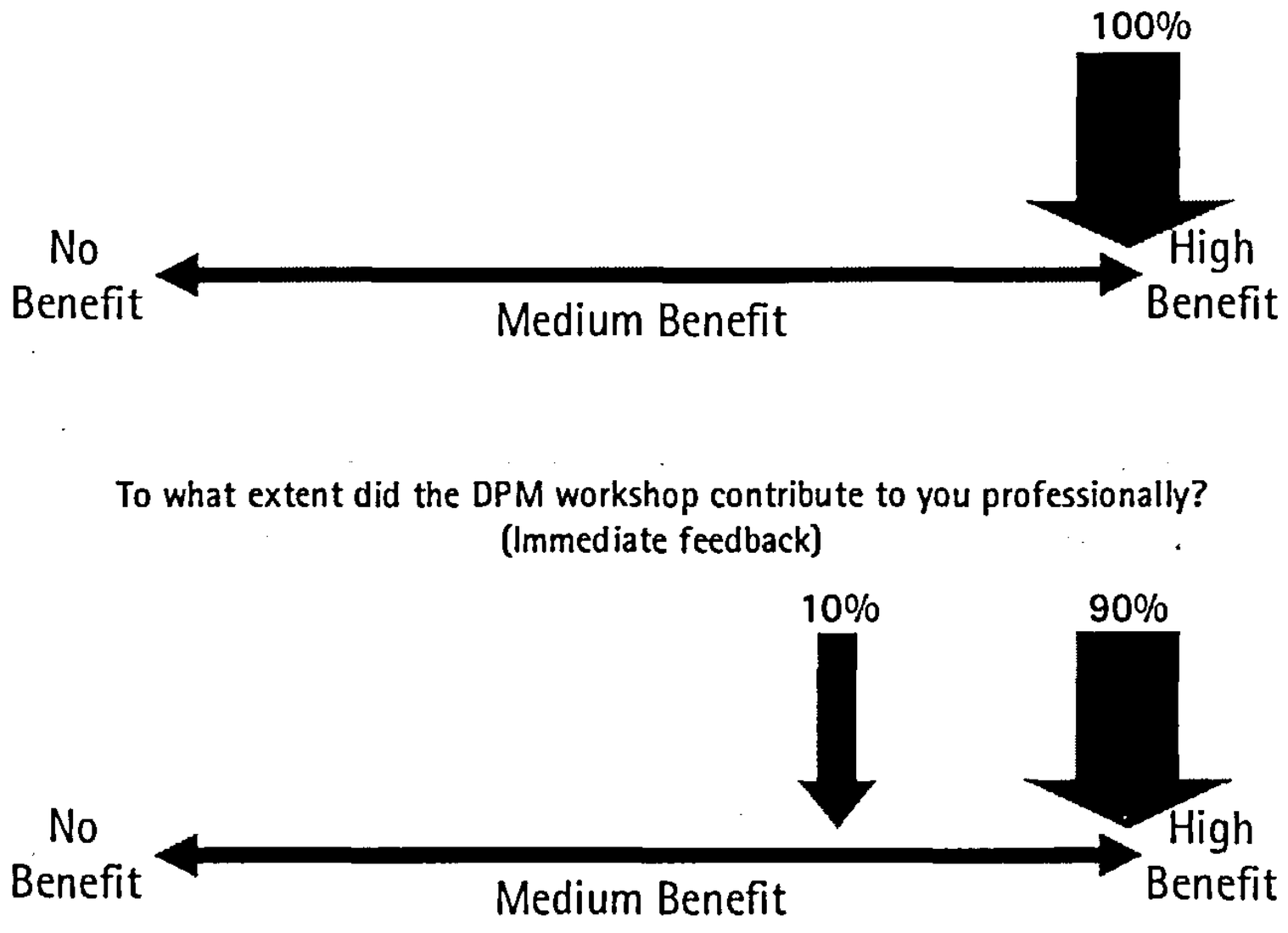


Figure 6-15: Case B's scalar rating assessment of the overall benefits delivered by the DPM methodology – completed immediately after the intervention.

Thus, the DPM intervention was viewed as a success and the Case B participants believed the process to have clear strategic relevance:

> *"The DPM enriches existing innovation management processes used in [Case B] today" [B-Head of Innovation Team-OE-DPM-3608].*

> *"[The DPM intervention] enabled a more thorough examination process then ever before" [B-Senior Engineer-IS-DPM-3609]*

☐ *The intervention delivered a clear, common and shared understanding of innovation activity:*

The overwhelming initial feedback from the management team from Case B was that the DPM intervention had significantly enhanced their ability to articulate a clear, common and shared understanding of their innovation activity. It was reported that this understanding included a view of where the company is today and how it could seek to pursue disruptive innovations in the future. It was this belief that also contributed significantly to the perception of a successful intervention.

6.3.2.2 Key feedback two months after intervention

☐ *Overall impact assessment of the DPM intervention:*

Two months after the intervention, the popularity of the DPM approach had diminished (Figure 6-16). Only 60% of the participants stated that they believed the approach had delivered high benefits to the organisation (compared to the original 100%) and the same 60% reported that the intervention had contributed to them professionally (compared to the original 90%). Despite this reduction, the DPM intervention was still viewed by the majority of the participants as a success. It is worthy of note that the group of participants who voted "high benefits", in both questions in Figure 6-16, comprised of the most senior members of the workshop – the DPM process appeared to be a strategically relevant tool.

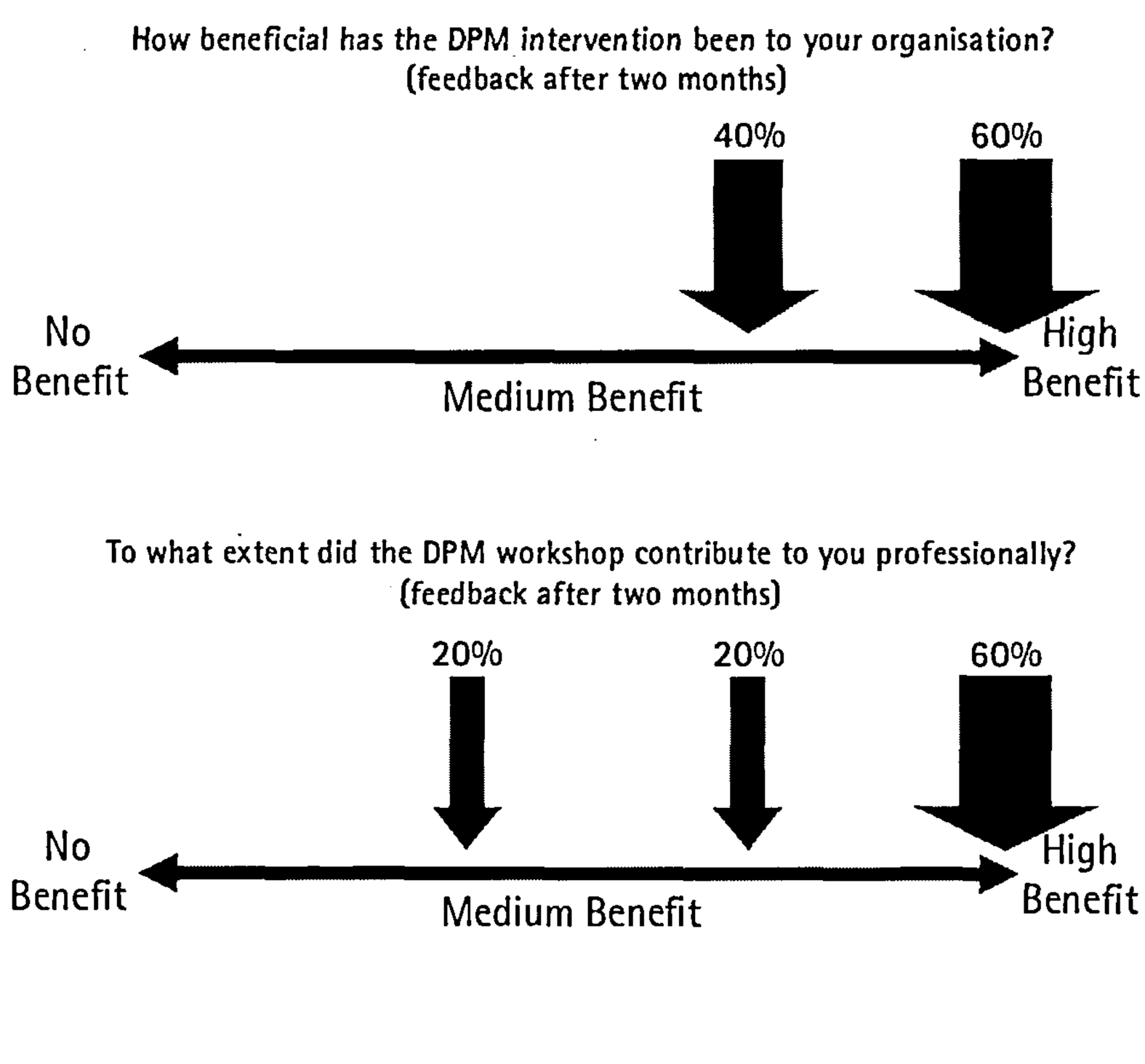


Figure 6-16: Case B's scalar rating assessment of overall benefit of the DPM methodology – two months after intervention.

☐ *The holistic view of the innovation playing field keeps people thinking about disruptive innovation.*

As previously stated, when deciding how to implement the DPM intervention, executive management within Case B had allowed the innovation team of one of its key divisions to take part in the process. This was a multi-functional team, that consisted of top management and senior engineers, who were responsible for increasing the innovative capability and capacity of the division. One month after the intervention, an executive management decision resulted in the disbandment of the team and its members were absorbed throughout numerous areas of the organisation. It was clear that impact of the DPM intervention could be significantly reduced or even terminated by such actions. However, all but one of the most senior members of the participating group reported that they were still "flying the flag for disruptive innovation". The former head of the innovation team reported that he was working with a group to consider how the learning from the DPM intervention could be integrated throughout his division. Moreover, it was reported that the use of the holistic view of the innovation playing field was the main reason as to why managers and engineers were still focusing time and energy on the topic of disruptive innovation.

☐ *Portfolio maps as a communication device:*

Two months after the DPM intervention, a senior engineer reported that a divisional director of R&D had been using the portfolio mapping approach (introduced to him by the DPM intervention). He was using the portfolio maps to communicate the strategic intent of the division's R&D strategy and to announce that resources were available to convert intent into action. This was not only a high level exercise; the use of the portfolio maps was being tested as a visual tool to encourage the day-to-day resource allocation decisions within a broader test bed of the workforce.

☐ *Case B declares the need for an on-going DPM tool:*

A senior engineer announced, in a presentation, that a Case B Programme Manager had recently stated in a meeting:

> *"The DPM increases the ability to more effectively organise and filter ideas... we need to make this part of our on-going process" [B-Programme Manager-IS-DPM-3543].*

He also reported that a senior systems engineer claimed

> *"It [the DPM approach] definitely gave us professional added value" [B-Senior Systems Engineer-HRM-DPM-3545].*

His presentation went on to conclude that his division, within Case B, was now seeking a way to adopt the core elements of the DPM methodology as part of a trial to improve decision making in planning and budgeting cycles. However he noted two problems, the first with the trial and the second with any potential roll out of the approach.

(1) The DPM approach that was used in the intervention was not 100% suitable:

> *"... the coexistence of other project assessment traditions in the company could make people confused... we have to be careful to make it appear like we're not really changing much... but we know that we will actually change a lot in terms of output" [B-Senior Engineer-IS-DPM-3552]*

(2) Significant top management support would be needed for a role out of the DPM approach:

> *"There could be a lack of support from divisional management to role out this sort of tool across their businesses; since this is a pilot and it is not in the main focus of the corporate management team, it does not drive the divisional heads to use it." [B-Senior Engineer-IS-DPM-3553]*

6.3.2.3 Key feedback six months after intervention

☐ *An on-going DPM tool – the human management issues:*

Following a series of meetings with the external consultants that observed the DPM intervention at Case B, and the subsequent process trials mentioned above, the senior management team expressed their interest in the full adoption of a DPM approach. It was reported that six months after the intervention a project team was now considering the establishment of a "Chief DPM Expert". This person would have two key responsibilities:

(1) coordinating portfolio management roll out, and

(2) training a group of "portfolio managers" to become experts in the delivery of the DPM workshop process and who would grow to be the foundation of a DPM community of practice.

☐ *An on-going DPM tool – the information management issues:*

The project team, responsible for considering the roll out of a DPM approach, were also looking at technical systems issues. They were investigating how the information that is required for the construction of valid and reliable portfolio maps could be best gathered and stored with minimal

disruption to current systems and processes. With over 1000 live 'ideas' the portfolio process was more complex but the principles were the same.

☐ *Disruptive innovation rejection strategies:*

The conscious and unconscious disruptive innovation rejection strategies, which were employed by the senior managers and engineers of Case B, received significant attention during the DPM intervention. However, this subject almost appeared off bounds after six months. Case B was notoriously difficult to penetrate; the top management neither like to share their organisation's intellectual property nor their weaknesses with anyone. Thus, it is not known whether the organisation was dealing with this issue or whether it was hoping that its new DPM processes would tackle these root causes of the resource allocation barrier.

6.3.3 Assessing the impact of the management intervention: a cross case analysis

This sub-section summarises a high-level cross case analysis of the impact of the management intervention. The next chapter presents and discusses the findings of the cross-case analysis of data from the two firm's resource allocation routines – this will offer a deeper understanding of their inhibiting affects.

- It was shown that management practitioners can obtain a holistic understanding of their priority innovation activity with large-scale graphics, which represent a holistic view of the innovation playing field, using the process and portfolio maps created by the DPM intervention.
- When the management teams were provided with a holistic understanding of their priority innovation activity, they reported that they found it easier to understand and to challenge or extend their prevailing mental model(s) (often referred to during the workshops as their 'viewpoint of what innovation is'). Consequently, they felt more freedom to legitimise investments into potentially disruptive innovation.
- It was reported that the use of large-scale graphics that represent a holistic view of the innovation playing field, can be used to improve the quality of management meetings arranged to discuss innovation activity. These improvements were reported to take three main forms:

(1) Improved quality of dialogue (in particular, it was more directed and broad);

(2) Enhanced communication of action and intent (in particular, it appeared easier to build consensus);

(3) The prevention of one person, group or project from dominating the resource allocation discussion.

- It was found that the desirability of pursuing disruptive innovation increases if the top management team sought to actively reduce the perception of risk surrounding the phenomenon. Reducing the perception of risk appeared to be achieved primarily through the combination of three actions:

  (1) The adoption of knowledge on the theory of disruptive innovation and staged financing approaches.

  (2) The recognition of prevailing mental models and an understanding of how they encourage the use of disruptive innovation rejection strategies.

  (3) An holistic view of innovation activity, which can be used to legitimise 'ring-fencing' resources for potentially disruptive initiatives.

- The adoption of knowledge on seed and staged funding approaches appears to be essential. It was believed if these approaches could be adopted into the resource allocation process it might help to ring-fence seed resources. Such a step could assist management practitioners to develop and deliver new potentially disruptive ventures whilst being impatient for profit yet patient for growth.

- It was found that employees were quite often involved in new potentially disruptive ideas, yet remained unaware of the concepts' potential for disruption and/or the difficulties in proceeding with such initiatives. Thus, it was reported by all the participants that their organisations require a team of 'disruptive-innovation-friendly executives' who can work with innovative employees to mould potentially disruptive ideas into disruptive business propositions. For example, they may help secure resources and training for the pursuit of more experimental, emergent approaches.

- It was found that the portfolio map output from the DPM process could be used as part of an organisational wide communication exercise. For example, it was shown that the portfolio maps could be used to create a call to arms. Furthermore, the maps were used to communicate a new vision of strategic intent to the participants, and it was reported that this could be

extended to other stakeholders. Moreover, it was reported that the maps could be used to display current innovation activity in relation to strategic intent and available resources. This allowed real time decisions to be taken with real immediate affect upon resource allocation in both case study sites. The most senior members of both intervention groups claimed that the visual aspects of the DPM approach could be developed to enhance visible support for organisational wide day-to-day resource allocation decisions; it could be used to encourage the sorts of actions that enable potentially disruptive innovations to be pursued.

In sum, it was found that management practitioners could use the DPM intervention as a way to acknowledge the source of problematic resource allocation routines. Participants in both cases, quickly realised that routines, deemed inappropriate to the support of disruptive innovation, were more linked to psychological and organisational inertial than to process and actual value measurements. With this realisation in hand, the DPM intervention allowed the participants to openly discuss how past and present behaviours and decisions were constraining the pursuit of disruptive innovation. It is these insights, and their explanations, that are missing from extant literature. Thus, it is these that are the focus of discussion in the following chapter in which a deeper understanding of the resource allocation barrier is provided.

6.4 Assessing the design and validity of the DPM management intervention

It is the belief of the author that the evidence gathered during the third wave of this research has contributed to the following key finding; this will be the focus of discussion in the remainder of this subsection.

> An holistic understanding of the innovation playing field (which includes sustaining, radical and disruptive innovations at a process, sub-system, product/service and business model level, with respect to current and new business opportunities) and how current priority innovation activity maps onto this area of opportunity, can be used to facilitate discussion to enable the surfacing and challenging of mental models that restrict innovation to incrementalism. These activities can be achieved by using a portfolio management approach that has been tailored to introduce and include the pursuit of disruptive innovation.

The DPM intervention was establish upon evidence and findings from data collection and data analysis protocols delivered by the first and second waves of this research. It is believed that

Chapter 3 demonstrated that the entire research methodology was rigorously developed will stand up to scrutiny, as a valid approach to the investigation in hand. Thus, to further assure the validity and reliability of the DPM intervention and the resultant observations, French and Bell (1990) contend the following two issues must also be considered (Figure 6-17):

Figure 6-17: Assessing the validity of management interventions (French and Bell, 1990)

6.4.1 Assessing the rigour of the design process and industrial utility of the intervention methodology

Consideration of the advice from French and Bell (1990), Silverman (2000) and Gibbons et al. (1994), led to the development of three assessment questions, the answers to which can be used to evaluate the rigour of the design process and the intervention:

a) Did the design process deliver an intervention methodology that met the objectives of the research?

b) What were the limitations of the conducting the interventions at the chosen sites?

c) Has the intervention worked (i.e. did it deliver what it was designed to deliver)?

- *A rigorous design process:*

It is the belief of the author that a rigorous design process was utilised for the development of the DPM intervention. This conclusion was drawn because of the following key reasons:

1) The benefits afforded by close collaboration were: increased trust between the industrialists and the author during the design phase and increased acceptance of the resultant intervention process. Van Maanen (1988) warns of the dangers of 'going native' when working closely with participants or cases. This issue was mitigated against during the design phase, by ensuring that the intervention was both needs and theory led and by collecting data from experts outside the research group.

2) The needs of management practitioners from the top echelons of average to low performing organisations were carefully identified. Vocalised needs were often not taken on face value; deeper needs were elicited through deep probing of the issues and by cross referencing findings with the literature and the data from the expert interviews.

3) A research focus was developed from the activity above; this was believed to be valid as the executive teams of the four case study organisations subsequently volunteered to test it without hesitation.

4) A collaborative method to the intervention design, using the iterative V approach, generated a specification for the intervention that was grounded in both data and theory.

5) The output of the design process – the DPM methodology – was an intervention that managers from all four case study organisations wanted to test within their organisations. On paper, it had met the design specification and could be used to probe the prioritised research focus area, whilst also delivering business benefits.

6) This research contributes to a larger research programme (as outlined in Chapter 3). The entire research programme was assessed on a yearly basis by a panel appointed by the European Commission's "Information Society Technologies Directorate", under their 5th framework research program. The DPM intervention was presented as part of this review process, first in its conceptual form, then later as a fully designed process and finally after it had been implemented. The review panel assessed the development and implementation of the intervention and concluded that it was a valid and valuable approach to the task in hand.

7) The fact that two manufacturing organisations committed and provided the time of their top management teams to be involved in implementing the intervention was a testament to its rigorous needs-and-theory-led design, and the rigorous methodology that was proposed.

- *The limitations of focusing the intervention upon cases A and B:*

The design process resulted in the creation of the DPM intervention methodology; it is believed that this methodology could be adapted to be implemented in almost any organisation. The choice to focus upon only two cases during implementation was explained in Chapter 3. As the chosen sites were willing to provide open access to their top management teams with open, honest and frank conversation, it is believed that the author faced few, if any, limitations during the implementations of the intervention process. However, the use of only two cases raises two key issues, (1) regarding the limitations of the generality of the conclusions and (2) in assessing the effectiveness of the intervention process. The issue of generality is discussed later in this chapter. The issue of whether or not the intervention was effective can be assessed on a case by case basis, as described in the following section.

- *Did the DPM intervention deliver what it was designed to deliver?*

In essence this subsection attempts to establish the industrial utility of the management intervention. The within case and cross case findings were used to complete a checklist developed to help assess whether the DPM intervention delivered what it was designed to deliver (Table 6-1). These conclusions were also subsequently approved by senior practitioners from both cases A and B.

Criteria for assessing the industrial utility of the management intervention.	Case A	Case B
a) On completing the intervention, at least 75% of the participants state that they believe they are in a better position to allocate resources to potentially disruptive innovations.	YES (100%)	YES (80%)
b) On completing the intervention, the majority of the participants state that the process implemented is one that could fit existing organisational routines and could be integrated into regular business practice.	NO (40%)	YES (100%)
c) On completing the intervention, the most senior participants state that they believe that the intervention could be used in the future to overcome the funding barrier and establish new resource allocation routines.	YES (80%)	YES (100%)

d) Two months after the intervention, the most senior participants state that they believe the intervention will deliver short to medium term benefits.	NO (40%) With modifications YES (100%)	YES (100%)
e) Two months after the intervention, the most senior participants show that the intervention has facilitated the establishment of new approaches to resource allocation that support disruptive innovation.	YES	YES
f) Two months after the intervention, the most senior participants state they believe that intervention may have significantly contributed to their ability to tackle the funding barrier to disruptive innovation in the long term.	YES (60%)	YES / NO (50%)
g) Six months after the intervention, the most senior participants state that they believe the intervention will deliver medium to long-term benefits.	N/A company ceased trading	YES (100%)
h) Six months after the intervention, the most senior participants show that the intervention has facilitated the establishment of new approaches to resource allocation that support disruptive innovation.	N/A company ceased trading	YES
i) Six months after the intervention, the most senior participants state they believe that intervention may have significantly contributed to their ability to tackle the funding barrier to disruptive innovation in the long term.	N/A company ceased trading	YES DPM processes adapted and internalised.

Table 6-1: Criteria for assessing the industrial utility of the management intervention and the responses from Cases A and B.

If it was possible to generalise from the experiences and findings presented in this chapter, then it would be possible to say that the management intervention holds significant industrial utility for today's average performing businesses wishing to pursue initiate the disruptive innovation.

At the time of writing this thesis, the R&D director from Case B reported that his team had completed further internal trials of the DPM methodology and he had taken the decision to adapt and incorporate the major elements of the process into the planning cycle of one of the main divisions. Furthermore, during May 2004, the author trained a senior consultant from Case D to use the DPM methodology; the process was later tailored to suit Case D's house style. In July 2004, Case D sold a three day DPM intervention process for €11,000 to one of its new major global clients. As a result of this intervention process Case D has was able to secure further consultancy work in assisting this client to delve into the previously unexplored area of disruptive innovation.

It would also appear that the DPM intervention can deliver significant additional benefits for average-to-low-performing business, beyond the aim of encouraging *support* for potentially disruptive innovations. For example, intervening with the DPM approach appears to:

- bring together people from different disciplines and better support functional boundary spanning communication.
- generate holistic consideration of the organisation's innovation effort by creating an opportunity to reflect upon and integrate technical, product and commercial perspectives.
- improve communication by creating a common framework for conversing and thinking strategically, which generates a better understanding of the firm's current position and enables the sharing of knowledge, ideas and opportunities for the future.
- bring together, either in recorded graphical form or through facilitated discussion, commercial, product and technological knowledge from inside and outside the organisation in a form that enables improved decision making.
- distinguish between process and product/service innovation, thus allowing the participants to regard component innovation to be a separate innovation stream (this means that component innovation is not restricted to the product in which it is a subsystem).

It would appear from the apparent success of the DPM intervention during this investigation, and since, that it has significant potential to support innovation strategy, planning and the pursuit of disruptive innovation. However, when considering the criteria upon which the intervention was developed it is clear that there are other approaches that such an intervention could have taken (for example, technology roadmapping, Phaal et al., 2004). Therefore, this intervention cannot be considered to be a 'black box solution'. The DPM methodology alone cannot deliver useful portfolio maps nor can it dispense intelligent decisions. To do this, it needs to be integrated with the soft or more human aspects of the portfolio management process and it requires a supply of accurate information. For example, a key benefit of the DPM process was the sharing of knowledge and the development of a common vision of where the organisation's innovation effort is focused today and where it could be focused in the future. This was only delivered during the interventions by peoples' willingness to share knowledge and make connections in the face-to-face workshop setting. Thus, many of the benefits of the DPM intervention were derived from the process rather than the output of the project assessments or the portfolio maps. Each application was a learning

experience and as such, a flexible approach was employed, this created an adaptable process that could suit the particular circumstances under consideration.

It was concluded that that a portfolio management approach, which is tailored to introduce and include disruptive innovation, can enable the surfacing and challenging of mental models that restrict resources to sustaining innovation. In sum, it was decided that the DPM intervention did deliver what it was designed to deliver,

6.4.1.1 Assessing the shortfalls of the DPM intervention

General discussion points and notes of caution regarding the intervention as a whole are presented in this subsection. A deeper discussion regarding the shortfalls of the intervention, with respect to weaknesses of the individual elements of the DPM process and issues that the DPM intervention overlooked or neglected, is offered in Appendix 7.

- *General observations and notes of caution regarding the intervention as a whole*

Despite the apparent benefits of the DPM intervention, the methodology must come with the following observations and notes of caution for consideration, of which any future iterations of the intervention must address:

- A business would probably need to invest in a number of iterations before the DPM intervention could be completely trusted as an effective management tool to facilitate improved strategic planning – this would require serious senior commitment and dedicated resources.

- The portfolio maps are powerful communication tools but the information within them is highly synthesised, revealing none of the finer understanding that is required to make effective decisions. Therefore, the users of the portfolio maps should have access to the completed dimensions raking checklists for each initiative, along with any other supporting information.

- The portfolio maps in their present guise do not show the dimension of time. They present a snap-shot of a world that is dynamic and changing in nature. Methods will probably need to be generated to chart the migration of initiatives as they mature.

- It was clearly apparent that the long-term value of the DPM intervention can only be realised if the process is kept alive and integrated into the business. This would mean that information must be kept up-to-date as events unfold, that information quality is ensured and that the output is reviewed as a major part of any budgeting or planning cycle. With this regard, the participants from both cases raised two main issues:

  - 1) Rolling out the process: It is believed that there are two routes for rolling-out the DPM process into planning cycles. Firstly, a top-down approach can be pursued, whereby the requirements and format of the portfolio management approach are prescribed by the top management team. Secondly, an organic approach can be pursued, whereby the benefits are communicated to business units or senior managers and the executive team provides support for an emergent roll-out. How the process is rolled out would be determined by the business culture and competitive demands; furthermore, an organisation wishing to maintain a DPM approach must consider how it can be integrated into planning cycles with the least amount of upheaval to the business.

  - 2) Information management: Simple spreadsheets, graphics packages and graphical facilitation approaches were used to implement the DPM intervention for this study. These approaches could be used to maintain further implementations of the DPM approach; however, information management complications could soon arise. This is not likely to occur in a small organisation such as Case A, however, if the tool was deemed an essential part of the on-going decision making process in Case B, then there could be a strong need for the organisation to adopt a dedicated information management system. This could be linked to prevailing project management/assessment and management information systems. Alternatively, a dedicated software solution could be made available to support the development, storage, dissemination and upkeep of the information that sits behind the portfolio maps.

6.5 Overview of findings in relation to research objectives: Wave III

The primary objective of this thesis is to *explore the nature and experience of management practitioners' pursuit of potentially disruptive innovations in average performing (or non-best-practice) businesses.* As shown in Chapter 3 (the research methodology), the third wave of this research contributes to this objective by focusing upon the satisfaction of the third sub-objective:

Sub-Objective 3:

To specify, design and implement a management intervention to probe a priority focus area of management action and cognition in order to build new academic knowledge, whilst simultaneously improving the ability of the participating organisations to pursue potentially disruptive innovations.

Thus, the third wave of this investigation was both an exploration and description of the barrier to potentially disruptive innovations caused by inappropriate resource allocation routines. Using the results of the first and second waves of this research as a springboard, data were collected over a 10 month period using interviews, telephone conferences, email discussions and workshops along with an iterative literature review in response to emergent demands. The analyses of the data along with the enfolding of literature revealed the need for a management intervention to tackle the case study organisation's inappropriate resource allocation routines. Concordantly, using an 'iterative V' approach a reliable and robustly designed management intervention was developed - the 'Disruptive Portfolio Management (DPM) Intervention'. This intervention was implemented in cases A and B - two manufacturing sites. Data were collected prior to and during the DPM workshops; furthermore, post-workshop data collection and analyses were conducted. The results of the DPM intervention have generated insights that address gaps in knowledge with respect to the resource allocation barrier – particularly focusing upon two units of analysis: management action and management cognition. Moreover, the results have led the author to believe that a pragmatic industrially relevant contribution has been made, alongside the development of significant academic understanding. The next chapter will discuss the key findings in an attempt to demonstrate new knowledge regarding the barriers caused by inappropriate resource allocation routines that inhibit the pursuit of disruptive innovation.

In sum, the conceptual framework, developed in the first wave of this research, has helped to ground the development of a management intervention that appears to have assisted two organisations to begin tackling their restrictive resource allocation routines. Moreover, the intervention has simultaneously addressed the academic need for new qualitative knowledge regarding this barrier to disruptive innovation. Accordingly, it is believed that these actions and results satisfy the third sub-objective.

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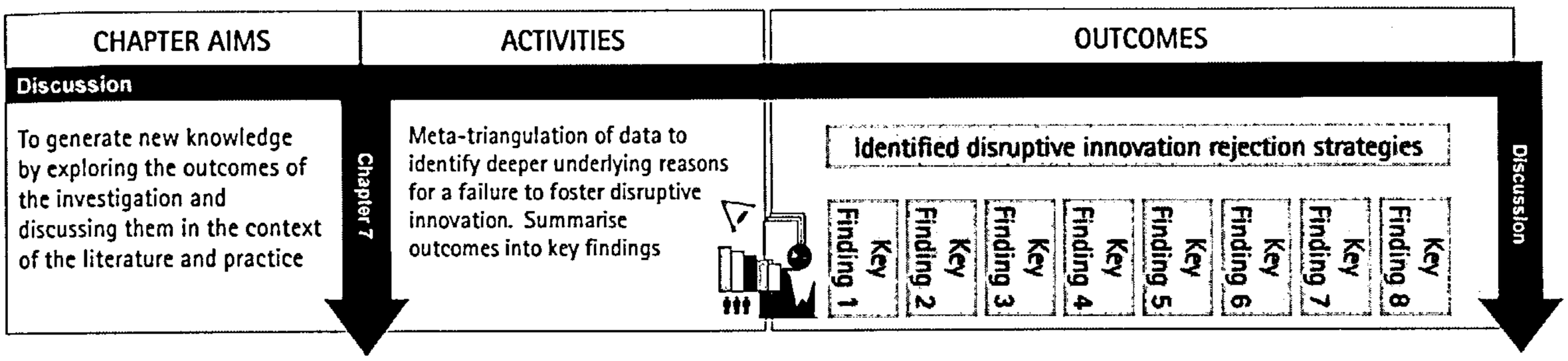
7. Discussion

This chapter first highlights the four main findings of the first and second waves of the research; it then focuses upon explaining and discussing the findings of the third and final wave. This third wave concentrated upon exploring and describing resource allocation routines, a critical area of management action and management cognition to which the pursuit of potentially disruptive innovations is highly dependent. Four key findings were generated in this final wave, each will be discussed in relation to theory and practice. The chapter will end with a summary and brief recommendations for practitioners.



7.1 Introduction

This thesis has been constructed in a series of steps that provide increasing focus to the research. The first step was to undertake a review of the literature, helping to construct the definition of the term 'disruptive innovation' used throughout the investigation and to identify gaps in knowledge. This review generated two research objectives and three sub objectives. The first wave of this investigation culminated in the development of a conceptual framework containing an holistic understanding of the tasks and difficulties that management practitioners face in the pursuit of disruptive innovation. The second wave of the research used this new framework to elicit managerial focus areas to which the pursuit of potentially disruptive innovations is highly dependent. The focus area referred to as 'inappropriate resource allocation routines' was prioritised and became the focal point for the remainder of the research. Consequently, the third and final wave of this research concentrated upon exploring and describing how and why resource allocation appears to be a critical barrier to the pursuit of disruptive innovation. A management intervention was designed and conducted; this generated a series of observations regarding the management actions and management cognitions that play a part in the resource allocation process. This chapter will show that analysis of these findings provides both a contribution to knowledge and to industrial practice.

Figure 7-1 provides a holistic view of the research process and in doing so it highlights the relationship between the initial research objectives and the findings presented and discussed in this in this thesis.

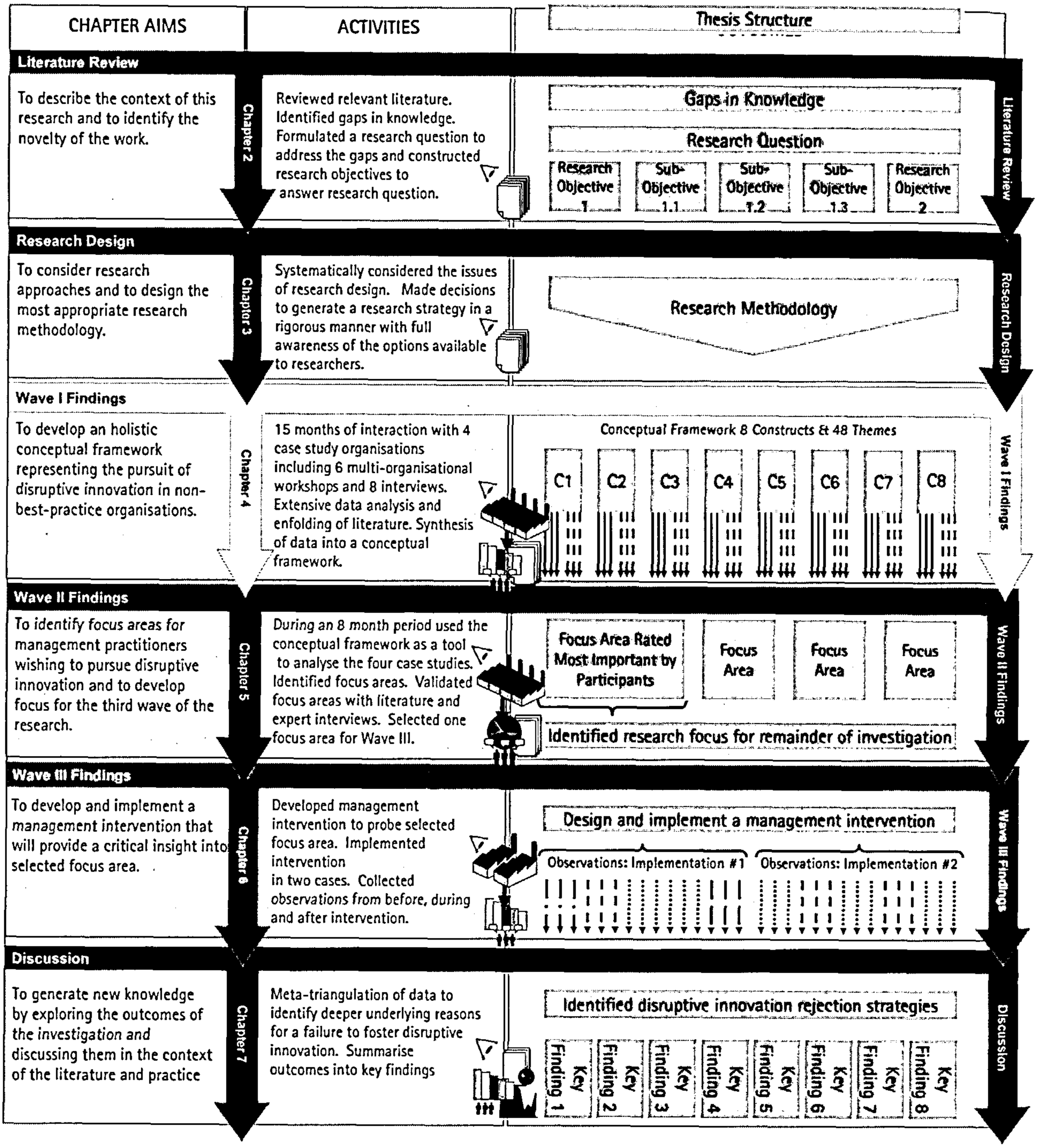


Figure 7-1: The research process

The first four key findings of this research have been presented and discussed in Chapters 4, 5 and 6

(i) the emergent conceptual framework of disruptive innovation;

(ii) the identification and description of four managerial focus areas;

(iii) the prioritisation of inappropriate resource allocation routines as an essential management focus; and

(iv) the finding that is possible to surface and challenge mental models that restrict innovation to the pursuit of incrementalism, by using a portfolio management approach that has been adjusted and tailored to introduce and include the importance of disruptive innovation.

This chapter is primarily dedicated to making sense of the third wave of results and discusses the key findings from this final phase with reference to extant theory and the context of application. Four key findings are presented and their novelty and relevance will be discussed; the chapter will end with a summary, followed by brief recommendations for practitioners.

7.2 The key findings from the third wave of research activity: A deeper understanding of inappropriate resource allocation routines

To investigate the barrier to the pursuit of disruptive innovation caused by resource allocation routines, the third wave of this research employed the implementation of a management intervention within two manufacturing organisations. This investigation has enabled the generation of new understanding regarding the pursuit of potentially disruptive innovations and the nature and root-cause of the barrier that is caused by inappropriate resource allocation routines. Thus, the issues raised in this section contribute to a deeper understanding of how and why resource allocation routines can inhibit the pursuit of potentially disruptive innovations; to this respect, three key findings are presented:

1. The identification of six regularly occurring management actions, which restrict resources to sustaining innovation.
2. The identification of five common disruptive innovation rejection strategies, which are the cognitive drivers of inappropriate resource allocation routines.

3. The observation that the higher the perceived intensity of disruption (e.g. a need for a change in strategic belief), the faster and more intense the disruptive innovation rejection strategies emerge.

These findings contribute to both extant theory and to the practice of innovation management – to industrialists involved in the tasks associated the pursuit of potentially disruptive innovations. Therefore, each of these key findings will be discussed within this section in terms of their relationship with existing literature and in the context of its meaning in application.

The push to assimilate these finding forced the author to reflect upon the use of the collaborative Mode 2 approach and the experiences of the three waves of this 33 month study. During this process three features have been identified as a novel contribution to the practice of collaborative research; these are offered as an additional and final key finding in section 7.3.

7.2.1 Common management actions that restrict resources to sustaining innovation

There are six most commonly occurring management actions that constrain resources to sustaining innovation within average performing businesses, and six 'idealised' management actions to which managers should aspire (Table 7-1 at the end of this subsection).

The analysis of current practice and anecdotal stories[1] that were told through the research, led to the identification of 21 common trends of management action that inhibit the allocation of resources to potentially disruptive innovations. These could be directly mapped to themes, combinations of themes or elements of themes within the conceptual framework (Chapter 4). The

[1] Throughout the third wave of research activities, anecdotal stories were told by the research participants on how their organisations had rejected or failed to capitalise upon projects that may have delivered disruptive innovations. Thirty-two anecdotes were recorded in total, nearly all of which were told on an informal basis; a further 11 such stories were also reported or discussed with the expert interviewees.

six most frequently recorded inhibiting management actions are presented here[7-2] (see also Thomond, Lettice and Herzberg, 2004):

- **Management Action 1: Managers deliver a narrow selection of innovation projects based on restricted 'views' of innovation**

The DPM intervention stimulated an holistic understanding of how the senior management teams in both cases A and B were allocating resources to their innovation effort; and it was instantly obvious that the participants had a narrow view of what innovation is. The intervention process enabled the participants to understand and question, for the first time, how their actions were restricting their organisations to a path of incrementalism, and that these actions were reactions to their personal and group view of what constitutes valid innovation. The head of the innovation team in Case B stated:

> *I feel like we've seen the light, now we know its time to get disruptive... and the only thing that will stop us, is us". [B-Head of Innovation Team-OE-DPM-3596]*

The literature (as presented in sections 5.7.2 and 5.6.2.5) allows us to understand that these narrow views can be described as the consequence of the cognitive dissonance experienced between disruptive opportunities and prevailing mental models of innovation.

- **Management Action 2: Managers increase the perception of risk regarding disruptive innovation and prevent the adoption of risk reduction strategies**

[7-2] These inhibiting management actions were also presented and discussed with the senior management practitioners from the collaborative research group and five other organisations that were involved in the wider research programme to which this investigation contributed. These senior practitioners reported they believed that the management behaviours were commonly prevalent within their organisations. The analysis and publication of these discussions are not included in this thesis for the sake of brevity and confidentiality.

Senior management practitioners, from each case, recounted times when they had been presented with an opportunity that had disruptive potential. During these reports, the practitioners stated they had recognised, and even felt, the existence of an inconsistency between their current understanding of their organisation and the new opportunity. These inconsistencies appeared to generate emotional conflict, which in turn induced an increased perception of risk. Once again, the literature (as presented in sections 5.7.2 and 5.6.2.5) allows us to understand that this conflict can be described as the result of cognitive dissonance experienced when prevailing restrictive mental models of innovation are challenged. Thus this second trend is linked to the first. Furthermore, it emerged that the effect of cognitive dissonance prevented the practitioners from seeking strategies for reducing risk (e.g. probe and learn tactics, staged funding, partnering etc.). Instead, the inverse was occurring, management practitioners at both cases were employing disruptive innovation rejection strategies.

- **Management Action 3: Managers prefer to handle tangible technical risk and avoid opportunities that appear to contain high commercial risk**

This third common management action was an extension of the second. Participants in both interventions asserted their confidence in their experiences and competences with their core groups of technologies. The result of this confidence was that they were more likely to favour projects with technical difficulties rather than those facing market uncertainties. It became clear that the practitioners associated disruptive innovations with the perception of increased commercial risk and, therefore, both cases showed time and again that potentially disruptive initiatives are not likely to be funded if risk is perceived to be high.

The introduction of notions such as empathic design (Leonard and Rayport, 1997) and probe and learn techniques (Lynn et al., 1996), which are reported to tackle commercial risks, helped to give both cases confidence in unfamiliar commercial niches. However, more work was needed in order for the management teams to truly embrace such concepts.

- **Management Action 4: Managements' pursuit of project-by-project planning reinforces a focus upon sustaining innovation and kills potentially disruptive opportunities**

Much of the new product planning processes within both cases appeared to be "done blind" - project-by-project planning dominated the innovation process. Evidence showed that the lack of an holistic view of innovation activity was increasing the reluctance of the management practitioners to allocate resources to potentially disruptive opportunities. In fact, the holistic views delivered by the DPM intervention revealed to the participants that their project-by-project approach had delivered imbalanced activity. The facilitation of holistic decision-making in both cases allowed the managers, for the first time, to consider the reasons and consequences of narrow project selection.

- **Management Action 5: Managers are tempted by "big money" mass market strategies and are reluctant to experiment**

A lack of knowledge regarding disruptive strategies underpinned the mind-set that potentially disruptive innovations should be directly focused upon existing mainstream customers. Even when evidence was provided to show that most disruptive innovations begin their lives in small target markets, consisting of low-end or emerging niche customers, managers still preferred the notion of targeting the 'big money' mass markets. It appeared that the executive management of all four cases were exerting pressure on their innovators to adopt mass market strategies (perhaps this could be explained in cases A and B as a result of both organisations facing difficult times). Consequently, product managers, and others responsible for allocating resources, assumed that projects for potentially disruptive innovations should be complicated, technically sophisticated and require mass investment. Small experiments were deemed inappropriate.

- **Management Action 6: Managers assess and measure all new product and service opportunities with preset, inflexible cost structures and targets**

As presented in the literature review (Chapter 2), disruptive innovations tend to start out as niche market propositions within an emerging market or the over-looked low-end customers of an existing market. By their very nature they require the acceptance of either, or both, low revenue threshold targets or low-margin price points. The managers of the case study organisations involved in this research were witnessed employing preset targets and cost structures in the assessment of new investment opportunities. As presented in the findings of the first wave of this research (Chapter 4), such over application of measures, which are effective for *sustaining* innovations to core customer offerings, leads to the unnecessary rejection of potentially disruptive innovations. To compound this further, the managers were unwilling to introduce flexible cost structures and targets for fear of investing in innovations that do not help to improve the bottom line of their businesses.

7.2.1.1 Identifying idealised management actions

The analysis of the outcomes from the third wave of research activity revealed the six most frequently observed common management actions to inhibit the allocation of resources to potentially disruptive innovations (described above). In effect, these could be considered as important characteristics of the 'disruptive innovation disabling organisation'. By reflecting upon these inhibiting actions, in the context of the conceptual framework of disruptive innovation (developed in Chapter 4), inverse, disruptive innovation enabling management actions could be proposed. In effect, a list could be presented illustrating important characteristics of the 'idealised disruptive-innovation-supporting-organisation' (Table 7-1).

The Disruptive Innovation Disabling Organisation: Inhibiting Management Actions		The Disruptive Innovation Enabling Organisation: Idealised Management Actions
1) Managers deliver a narrow selection of innovation projects based on restricted 'views' of innovation.	Vs	1) Managers' project selection reflects their 'view' that valid innovation activity includes sustaining and disruptive innovations.
2) Managers increase the perception of risk regarding disruptive innovation and prevent the adoption of risk reduction strategies.	Vs	2) Managers do not see potentially disruptive opportunities as 'more risky'; they seek to address the issue of risk with equity across all innovation types.
3) Managers prefer to handle tangible technical risk and avoid opportunities that appear to contain high commercial risk.	Vs	3) All risk is assessed in terms of the probability and scale of impact, and mitigated against accordingly.
4) Managements' pursuit of project-by-project planning reinforces a focus upon sustaining innovation and kills potentially disruptive opportunities.	Vs	4) Managers have a holistic understanding of their innovation activity and make decisions accordingly.
5) Managers are tempted by "big money" mass market strategies and are reluctant to experiment	Vs	5) Managers actively pursue a broad portfolio of small experiments/investigations and are willing to test and grow new concepts in small emerging or low-end markets
6) Managers assess and measure all new product and service opportunities with preset inflexible cost structures and targets.	Vs	6) Managers actively distinguish between sustaining and potentially disruptive innovations and accordingly apply differential cost structures and targets.

Table 7-1: Key Finding 4 – The critical differences in management actions within the resource allocation process between the average performing the 'idealised' organisation.

7.2.1.2 Summarising the contribution made by the probing of restrictive management actions

Each of the common disabling and idealised management actions (outlined in table 7-1) have been described to a greater of lesser extent by past authors, in particular, Christensen (1997), Christensen and Raynor (2003), Dougherty and Hardy (1996), Noda and Bower (1996), Hamel (200), Leifer et al. (2000) and Burgleman et al. (1996). Therefore, this research contributes support to the salience of these management actions. In fact, their industrial relevance was also observed when the findings presented in Table 7-1 were extended and used by management practitioners involved

in this research as a checklist by which to assess their management team's likeliness or capacity to allocate resources to potentially disruptive opportunities. However, Senge (1990) has noted that linear descriptions of management actions do not 'get to the core of the issues at hand'. Such a statement in the context of the findings above, leads to the requirement for a deeper understanding of *why* the inhibiting management actions occur in the first place, only then can prevailing knowledge be extended and an effective contribution established. Thus, although 'key finding 4' is a valid finding from this research, it has limitations that prevent it from being asserted as a contribution to the better understanding of inappropriate resource allocation routines and the pursuit of disruptive innovation.

The literature review, which was conducted throughout all three waves of this investigation, demonstrated a general lack of attention to management practitioners' cognitive processes in relation to discontinuous innovation. This was consistent with the findings of Kaplan et al. (2003), Tripsas and Gavetti (2000) and White and Bessant (2004). Consequently, the current investigation has attempted to address this gap and to answer the calls of these authors, by providing insights into the cognitive processes that underpin managerial actions and reactions, with respect to disruptive innovation. This discussion has therefore adopted a stance, also taken by White and Bessant (2004), of considering theories and literature written and inspired by the seminal author in cognitive psychology, Festinger (1957). Thus, there has been a focus upon management action *and* management cognition as the primary units of analysis, and the analyses has been conducted as a "metatriangulation" (Lewis and Grimes, 1999) - where understanding is developed via the assessment of multiple perspectives and paradigms. The following subsection will present a contribution to knowledge, by discussing the management actions that delivered inappropriate resource allocation routines, through the often overlooked perspective of managerial cognition – in particular cognitive dissonance.

7.2.2 Disruptive innovation rejection strategies: cognitive drivers of inappropriate resource allocation routines

> The commonly occurring management actions that restrict resources to sustaining innovation are driven by management cognitions that promote and maintain the use of five disruptive innovation rejection strategies (Figure 7-3).

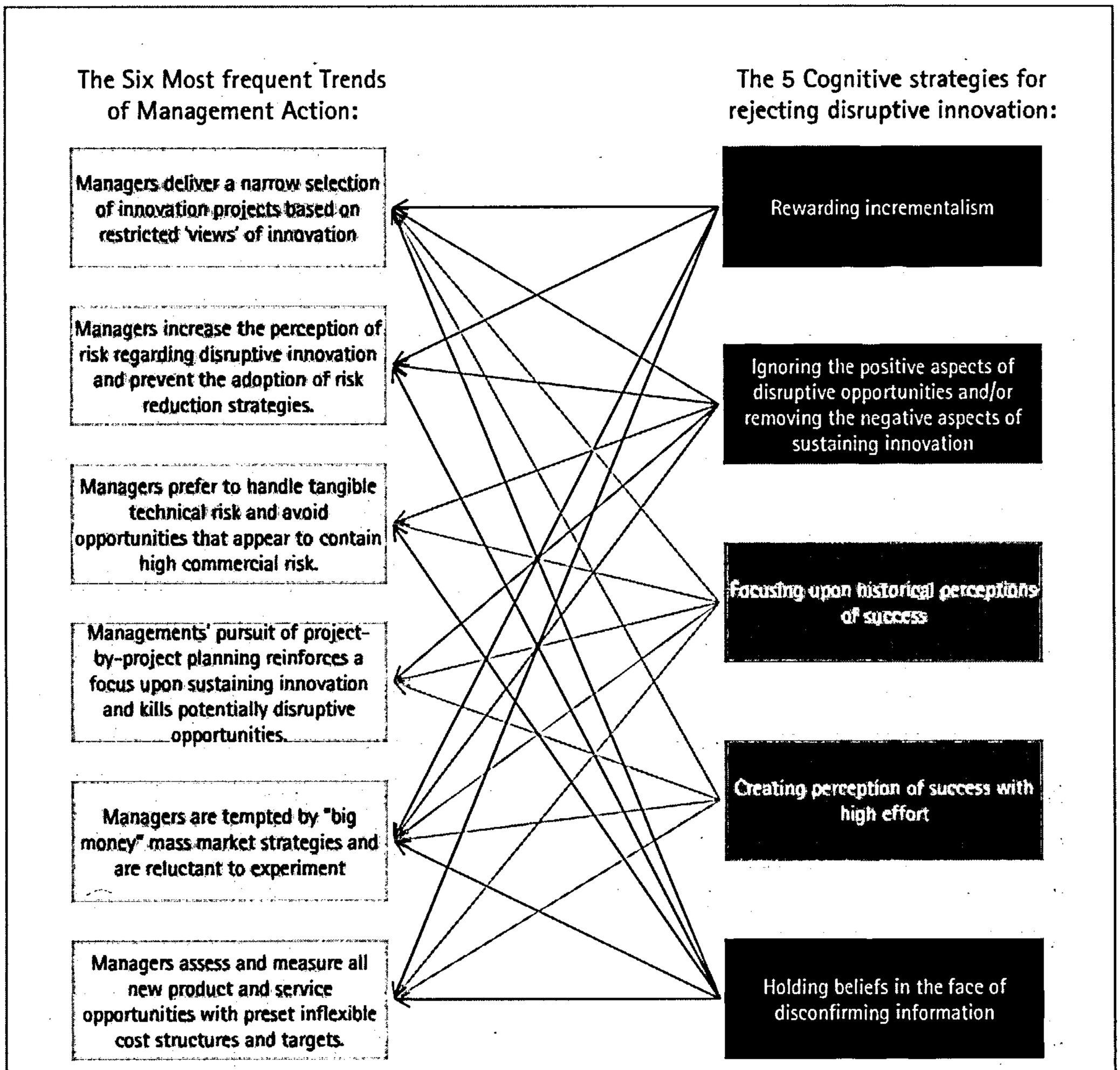


Figure 7-2: Trends of management action and cognition that inhibit the allocation of resources to potentially disruptive innovation.

The data sets of the six common inhibiting management actions were further analysed, alongside the anecdotal stories of failed or rejected potentially disruptive innovations. This led to the discovery that each of these management actions and stories was underpinned, to a greater of lesser extent, by five, discrete, disruptive innovation rejection strategies. Further analysis revealed that each rejection strategy was driven by the management practitioners' experience of a

phenomenon that Harmon-Jones and Mills (1999), Beauvois and Joule (1996) and Festinger (1957) call 'cognitive dissonance'[7-3].

It is therefore these findings that become the focal point of the discussion presented in the remainder of this section.

7.2.2.1 Rejection Strategy 1: Rewarding incrementalism

> When presented with a potentially disruptive opportunity, managerial psychology, particularly the experience of cognitive dissonance, focuses managements' attention upon prevailing explicit and implicit incentives as a way to reward sustaining change and to reject potentially disruptive alternatives.

One strategy used by management to avoid funding potentially disruptive ideas was to focus upon prevailing organisational rewards. It was found in both cases that the prevailing explicit and implicit rewards had a negative effect upon practitioners' decisions to fund potentially disruptive opportunities (where explicit rewards include financial incentives and promotions, and implicit rewards include a sense of belonging and respect from peers (Unsworth, 2001; Amabile, 1997). The rewards reduced creativity and caused management to disregard evidence that suggested their organisation's current resources, technologies or business models may be put to better use in opportunities differing to current practice.

For example, in Case B, it emerged that job creation was an important implicit performance measure that was rewarded by top management. Thus, the initiation of new product development projects for small niche markets, as characterised by disruptive innovations, gained little support in comparison to investment opportunities with familiar technologies that could generate immediate large scale job creation. In fact, in the 1990's, this implicit reward had driven Case B to incrementally increase the scope and quality of the specification of a contract with the US government. Consequently, when the customer cancelled the order, because of policy change and

[7-3] Two cognitions are said to be dissonant if one does not follow from the other; the existence of cognitive dissonance is psychologically uncomfortable. Such discomfort motivates efforts to reduce the experience of dissonance and various strategies can be used. The greater the magnitude of the dissonance, the greater the pressure to employ dissonance reducing strategies (Harmon-Jones and Mills, 1999).

major technological over-supply, Case B suffered a significant setback. In Case A, explicit rewards were focused upon current production line enhancements – once again steering management's attention to incrementalism. Moreover, both cases A and B appeared to display an "Emergency Room" culture (Allen et al., 1999), especially case A. This was characterised by the existence of implicit rewards for the ability to conduct 'rapid fire' analyses of situations, where judgements need to be made quickly, along with prompt action. When implicit rewards exist for reacting quickly, making fast assumptions and insisting upon quick action, there appears to be little support for suspending judgement, building empathy for new ideas and nurturing potentially disruptive concepts. When such a culture dominates and is rewarded, creativity would seem to be reduced and new ideas are quickly killed. This prevents ideas for potentially disruptive innovations from being developed or shared between individuals or across organisational boundaries.

Thus, how an organisation's key innovation stakeholders are incentivised, appears to have a significant impact upon the pursuit of innovations that are characterised as counter-intuitive or counter to historic trajectories of development, such as potentially disruptive opportunities. This finding has important implications for executive management teams. As such, a proposition can be immediately drawn from the discovery of this disruptive innovation rejection strategy: executive teams should intervene with the reward systems within their organisations in order to ensure the simultaneous pursuit of sustaining and disruptive innovations. Particular attention must be given to uncovering and changing both implicit and explicit incentives and rewards that undermine the pursuit of innovation that moves beyond the steady state.

Discussing the validity of this finding:

To investigate the validity of this finding, both the participants of the wider collaborative research group and literature from the fields of cognitive dissonance and innovation were consulted.

The strategy of rewarding incrementalism was presented and discussed in a workshop setting with senior management practitioners from Cases C and D and five other organisations that were involved in the wider research programme to which this investigation contributed. Despite some initial hesitancy, the participants began to 'admit' that they, or other members of their organisations, had resorted to only rewarding incrementalism when afflicted with cognitive dissonance. Thus the existence of this disruptive innovation rejection strategy has been ratified by a wider group of industrialists.

Writing in the field of organisational creativity, Amabile (1997) suggests that the negative effects of rewards upon creativity and innovation are common for many businesses. Moreover, it would appear that the discovery of this disruptive innovation rejection strategy contributes a new context of application to two domains of knowledge: the theory base of knowledge management (in particular the topics of knowledge transfer and intellectual capital) and social psychology (in particular the construct of cognitive dissonance).

Literature from the academic domains of knowledge transfer and intellectual capital appear to provide further evidence as to why managers may find it implicitly easier to reward incrementalism – it is easier to absorb knowledge from people with whom it is easy to communicate. Stewart (1998) has stated that management practitioners are implicitly rewarded for the fast transfer of company codified information. However, information regarding potentially disruptive opportunities is more likely to be tacit than codified because of its emergent nature (Burgleman et al., 1996). This means there are difficulties, and an implicit lack of incentive, attached to the management and transfer of tacit knowledge – especially between organisational silos (Stewart, 1998). Reagans and McEvily (2003) found that the transferral of tacit knowledge requires strong ties to be in place between the relevant actors within the organisation; however, without incentives and support, strong ties may fail to materialise. Consequently, tacit knowledge transfer continues to struggle against a natural preference for the transfer of easily codifiable knowledge. This provides an insight into why knowledge regarding potentially disruptive innovations often fails to permeate organisational boundaries because of the implicit reward for the easily transferred knowledge embodied by incremental innovation.

Probing more deeply into the emergence and impact of cognitive dissonance, research has been conducted, for decades, into the uptake of counter-attitudinal behaviours and induced-compliance. For example, Festinger and Carlsmith (1959) proposed the existence of a negative-incentive effect. The participants in their experiments would display more positive attitudes towards engaging in a counter-attitudinal behaviour when smaller rewards were received. Thus, there appears to be a negative relationship between the amount of incentive and the amount of attitude change in support of the counter-attitudinal behaviour; however when no incentive was present, there was no support. Linder, Cooper, and Jones (1967) replicated and extended these findings. They showed that the negative-incentive effect occurs when people feel free to decide about engaging in the counter-attitudinal behaviour. However, they found where attempts were made to induce compliance, when there was no perceived freedom of choice to engage in a counter-attitudinal behaviour, there was a positive relationship between the amount of incentive and the amount of

attitude change. Thus, in a paradigm of induced compliance, the more an incentive is provided, the more positive the attitude towards desired counter-attitudinal change will be.

Beauvois and Joule (1996) state that today's psychologists continue to successfully utilise the negative-incentive and induced-compliance paradigms when considering the impact of cognitive dissonance and the uptake of counter-attitudinal behaviours. They also note that these theories have failed to significantly permeate domains outside that of psychology. Despite this, these findings from social psychology appear to clarify a major observation of this thesis: rewards and incentives, both explicit and implicit, influence the perception of counter-attitudinal behaviours by subjectively increasing or decreasing the amount of cognitive dissonance experienced.

In sum, the investigation revealed the existence of a disruptive innovation rejection strategy caused by cognitive dissonance, whereby management practitioners focus upon rewarding incrementalism to remove the experience of psychological discomfort. This finding was combined with the literature above to offer the following propositions:

It was found that the holistic graphical approaches used in the interventions within cases A and B enabled the development of a common cross functional vocabulary. Perhaps the use of such holistic images could enable management practitioners to tackle the weak ties between technologists and business managers. If so, this could improve the transfer of knowledge and ideas regarding potentially disruptive innovations and increase leverage from previously non-rewarded intellectual capital.

To simultaneously pursue sustaining and disruptive innovations executive teams could intervene with reward systems to bring them into line with knowledge from social psychology in the following manner:

Driver for disruptive innovation	Applicable Psychological Paradigm	Management Action
Top-down driven demand for pursuit of disruptive innovation	Induced-compliance	Large explicit and implicit rewards and incentives.
Top-down supported grass-roots emergence of disruptive innovation	Negative-incentive	Small/token incentives with explicit rewards based upon growth of the potentially disruptive innovation

Reappraising reward systems links with the growing belief that rewarding with stocks and shares may not be good enough in the future (Handy, 2001). Handy (2001) notes that the increasingly discontinuous nature of many industries makes stocks and shares a risky way of rewarding talent, for both employees with little direct control over share price or stock valuations and for people who make real cash investments into their business.

7.2.2.2 Rejection Strategy 2: Ignoring the positive aspects of disruptive opportunities and/or removing the negative aspects of sustaining innovation

> When presented with a potentially disruptive opportunity, cognitive dissonance can force management practitioners to ignore the positive aspects of potentially disruptive opportunities and/or remove the negative aspects of sustaining alternatives.

Participants of the DPM interventions, from both cases, admitted (in retrospect) to occasions where they rejected potentially disruptive opportunities, in favour of sustaining innovation, by removing the positive aspects of the rejected prospect and/or removing the negative aspects of the chosen initiative. For example, in case A the management team had recently faced a decision between two dissonant projects: Should they (A) increase the allocation of resources to a project that was to deliver a new high-end product in their existing core range or (B) invest resources into a project with disruptive potential in a new and totally different emerging market?

(A) The senior management were insistent that they could deliver new wealth generation by educating customers to move into the high performing end of their market (where they forecasted higher revenues and higher margins). In doing so they ignored the evidence which showed that most of their customer losses were to be found at the low-end of the market and that the high-end was small, shrinking and already saturated. Much of the customer base, it would seem, were now happy to purchase cheaper, lower quality, substitute products from China.

(B) Alternatively, evidence showed that the emerging market within the unfamiliar industry (although currently small with only potential for large growth) could provide Case A with a new high margin revenue stream. Competitive intensity within the market for the new concept was low and the current players were ignoring non-consumers and low-end customers who were in a situation of massive technology oversupply. Furthermore, the

current players did not have as advanced technology and facilities as Case A to deliver the potentially disruptive proposition, which was based upon a cluster of simpler technologies.

Despite the evidence, the potentially disruptive opportunity was labelled by the senior management team as 'too risky' for two reasons: (1) they felt the emerging market was "not yet large enough" and (2) they were "too unfamiliar with the emerging industry". The positive aspects of the opportunity with disruptive potential were removed and the lack of promise in manufacturing high-end products was *ignored.*

The discovery of the existence of this disruptive innovation rejection strategy has important implications for executive management teams. As such, a proposition can be immediately drawn from this finding: executive teams who want their organisations to simultaneously pursue sustaining and disruptive innovations should create an environment where management practitioners do not feel compelled, either consciously or subconsciously, to ignore the positive aspects of potentially disruptive opportunities and/or remove the negative aspects of their sustaining alternatives. Employees should be able to see the true value and benefits of an innovation opportunity regardless of its 'type'.

Discussing the validity of this finding:

The strategy of ignoring the positive aspects and/or removing the negative aspects of innovation options was presented and discussed in a workshop setting with senior management practitioners from Cases C and D and five other organisations that were involved in the wider research programme. As with the first rejection strategy the participants 'admitted' (once they had overcome initial hesitancy) that when afflicted with cognitive dissonance they, or other members of their organisations, had resorted to ignoring the positive aspects of potentially disruptive innovations and/or the negative aspects of sustaining innovation. Thus the existence of this disruptive innovation rejection strategy has been ratified by a wider group of industrialists.

Once again Reagans and McEvily's (2003) work, from the field of knowledge transfer, appears to provide a vocabulary to explain these observations within cases A and B. Managers seemed to find it easy to ignore the positive aspects of a potentially disruptive innovation as there were weak ties between the senders and the receivers of the tacit knowledge involved. Whereas, it did not matter whether the ties between the actors involved in the transfer of the codified knowledge for sustaining innovation were weak or strong as prevailing high levels of construct equivalence

(Welkenhuysen-Gybels, and Van de Vijver, 2001) facilitated the fast transfer and adoption of information and knowledge. Therefore, this perspective suggests that it may be natural to ignore the positive aspects of disruptive innovation because of the difficulties involved in tacit knowledge transfer.

The concept of 'comprehensiveness', from the field of context based decision making, offers another perspective from which to consider this disruptive innovation rejection strategy. Fredrickson (1984) states that the degree to which an organisation's top management seek to be exhaustive or inclusive in formulating and integrating strategic decisions can be referred to as the level of comprehensiveness. Fredrickson and Mitchell (1984) have shown that the level of comprehensiveness has a positive relationship with organisational performance under stable environmental conditions. However, in unstable conditions there exists a negative relationship between comprehensiveness and performance. This has significant implications for managers pursuing potentially disruptive innovations. As was shown in chapter four, different strategic, managerial and information gathering approaches are required when pursuing sustaining and disruptive innovations - innovation contexts that can be described respectively to be inherently stable and unstable (Tushman and Anderson, 1986). Most senior executives will have historically found themselves facing the need for comprehensive management in relatively stable contexts (Liefer et al., 2000). However, such an approach appears to inhibit strategic, managerial and information receptivity approaches when pursuing potentially disruptive technologies and business models. An understanding of the comprehensiveness sought by management practitioners could, therefore, be used to explain why managers may ignore the positive aspects of disruptive innovations and the negative aspects of sustaining innovation. For example, sustaining innovations are more likely to satisfy the requirement of comprehensiveness; alternatively, potentially disruptive innovations are more likely to be based upon emergent, incomplete knowledge and insights into future trends for a given technology or demand. This is information that is neither exhaustive nor conducive to deliberate comprehensive strategy making, thus suiting a more emergent approach (Mintzberg et al., 1998).

Therefore, the concept of comprehensiveness provides an insight as to why the positive aspects of a potentially disruptive innovation may be ignored - such an investment option is unlikely to meet high levels of comprehensiveness demanded by established organisations. Equally, the perceived value of a sustaining innovation may be exaggerated, if it is presented as a comprehensive investment option. This perspective highlights that cognitive dissonance is once again playing its part in the decision to fund potentially disruptive innovations.

Offering a deeper understanding of how people respond when attempting to reduce the experience of cognitive dissonance are Shultz and Lepper (1996), who have investigated an area of human behaviour they call 'spreading of alternatives'. In fact, their description of how people behave when making efforts to reduce cognitive dissonance almost provides a verbatim description of the disruptive innovation rejection strategy observed in this subsection. They state that a person who experiences cognitive dissonance, when forced to make a choice between two alternatives, will seek to reduce their perceived discomfort by removing the negative aspects of the chosen alternative, or the positive aspects of the rejected alternative. As described above, managers from each of the case study organisations admitted to disregarding negative aspects of selected incremental innovation opportunities, thus, making them more preferable to their potentially disruptive counterparts. They also ignored the positive aspects of the rejected potentially disruptive alternatives in order to justify their choices yet further.

Thus, this investigation has contributed a practical business context to which the notion of 'spreading of alternatives' is relevant. It would appear that this could be major cause of practitioners' habitual mismanagement of the resource allocation process and the restriction of potentially disruptive opportunities. The spreading of alternatives paradigm could, therefore, underpin problems with knowledge transfer and the seeking of comprehensiveness described above. This finding must be highlighted as a concern to industrialists and as area of further investigation for social scientists and psychologists; furthermore, it can be used to generate the following proposition:

To simultaneously pursue sustaining and potentially disruptive innovations, employees must be able to garner true representations of the value and benefit of all investment options. This can be achieved by reducing the dissonance between these differing types of innovation objectives, which can be delivered with executive management support for both deliberate and emergent approaches to management and strategy.

7.2.2.3 Rejection Strategy 3: Focusing upon historical perceptions of success

When presented with a potentially disruptive opportunity that psychological inertia, caused by organisational memory, creates a focus upon historical perceptions of success and the rejection of alternative perspectives.

> *"We've always been the world leaders in 'product X'", said the director of R&D in case B, "we are the best in the world, no-one can make those like we do" [B-Director of R&D-OE-199 & IS-200].*

Almost the whole management team in Case B became comfortable with the idea that they could generate 'disruptions' in unfamiliar market places. However, past success, with world beating technologies, made many of them believe that they would not be disrupted in their current mainstream markets, despite preliminary evidence of technology over-supply in several core product categories. Similar evidence was present in Case A. It seemed that there existed an organisational memory, within both organisations, for the factors that have been responsible for past success and that this had become embedded in the cognitive processes of the organisation's management practitioners. Consequently, prevailing perceptions of success were preventing the practitioners from visualising or embracing the potential for disruptive change in their primary technologies and customer offerings. Ideas that went against the grain of history generated cognitive dissonance and consequently did not get funded. Thus, it was observed in both cases that the notion of taking current technologies and competencies to unfamiliar markets with disruptive strategies was a more appealing proposition, yet both organisations preferred what they deemed to be safer investment options.

This disruptive innovation rejection strategy has significant implications for executive management teams and the stakeholders of organisations who see the longevity of the business as paramount. As such, a proposition can be immediately drawn from the discovery of this finding: Executive teams must ensure that their workforce is proud of its history but not tied to it. Core competencies soon become core rigidities (Leonard-Barton, 1992) in the face of disruptive innovations. They should be prepared to celebrate their organisation's competencies whilst also preparing to both learn and unlearn for the future.

Discussing the validity of this finding:

The strategy of focusing upon historical perceptions of success was presented and discussed in a workshop setting. The wider group of industrial participants (the senior management practitioners from Cases C and D and five other organisations that were involved in the wider research programme to which this investigation contributed), ratified the existence and use of this rejection strategy. Despite some initial hesitancy, the participants 'admitted' that they, or other members of

their organisations, had resorted to maintaining a focus upon historically valued perceptions of success when afflicted with cognitive dissonance.

This finding appears to contribute to the body of knowledge from the domains of knowledge management and organisational learning – in particular the characteristics of organisational and managerial psychology in both. For example, information and knowledge is said to be embedded within individuals, relationships, culture, processes, structures, archives and artefacts (Stewart 1998). When management practitioners recall this information and knowledge from their organisations' history, they are in effect, drawing upon their organisational memory (Senge, 1990). Authors writing in the domains of knowledge management and organisational learning, who assert the notion of organisational memory, such as Senge (1990), Lukas and Bell (2000), Olivera (2000), Walsh and Ungson (1991), show that an organisation's memory can influence organisation wide decision-making. As outlined in Chapter 2, DeBono (1968 and 1988) offers the construct of psychological inertia to explain how and why people get trapped into ways of thinking and being, thus finding it difficult to change. The effects of organisational memory can be paralleled to this inertia and how an individual's memory can affect their day-to-day decision-making.

Berthon et al. (2001) applied the construct of organisational memory to decision making in the marketing arena. They found that small, young companies with low levels of content in their organisational memories' rely more upon external sources of information compared to their larger, established competitors. Authors in this field contend that that a deep and rich organisational memory can be both enabling and debilitating (DeBono, 1988; Walsh and Ungson, 1991). It can ensure that management practitioners have increased access to sources of learning and are less likely to repeat errors. However, it is also claimed that it can restrict people to familiar ways of thinking and making decisions. For example, Walsh and Ungerson (1991) note that decisions which are not framed within the context of an organisation's history are more likely to be met with resistance than those that are congruent with its history.

It is believed that the results presented in this thesis would indicate that the concept of organisational memory has clear implications for disruptive innovation - a topic to which this construct has not been frequently paired. It would appear that the major challenge for management practitioners in an established organisation is to use their organisational memory to positive affect, whilst simultaneously preventing it from constraining decision making - thus alleviating the focus upon historical routes to success.

Authors in the broad fields of organisational behaviour and management studies will often refer to the influence that the senior executives assert over their organisations through processes called "sense-making" and "sense-giving" (e.g. Gioia and Chittipeddi, 1991; Watson, 1995). Gioia and Chittipeddi (1991) have shown that a manager is sense-making when he or she attempts to assess their external organisational context and allow their observations to influence a change in their opinions and viewpoint regarding their business and its future. Alternatively, they contend that managers are sense-giving when they disseminate their response to sense-making activities – often via the communication of new plans, new programmes or new visions.

Handy (2001) has claimed that the process of sense-making, for younger organisations, relies upon active and continuously evolving processes. These on-going activities, allow managers to identify emergent information regarding their performance and their organisations' wider domain, thus generating a responsive emergent approach to organisational development and strategy. Handy (2001) also demonstrated that older, established organisations will mostly engage in more formalised and even passive sense-making. He states the executives from these organisations often believe their understanding of their external organisational context is much greater than what it really is (he insists that many rely upon buying or appropriating from smaller, more nimble organisations for true innovation). Christensen and Raynor (2003) and Hamel (2000) have illustrated that problems can evolve when using industry specific, formalised sense-making approaches. The implication is that executive management teams of established organisations become obligated to deliberate strategy approaches, based upon a fixation upon historical perspectives of performance and success. Consequently, potentially disruptive opportunities are often assessed by the same criteria as their incumbent offerings - through the filter of past experiences. Kaplan (1999) proposed that organisational activities are more likely to produce both sustaining and disruptive innovations, if executive management and employees are in acceptance of the notion that all technologies, customer offerings and business models have limited life cycles. Such an acceptance would allow "sense-making" and "sense-giving" activities to be free of the bias of overbearing organisational memories and would allow leadership to challenge any prevailing psychological inertia.

The results presented in this thesis suggest that the construct of organisational memory should be considered in more depth within the context of the pursuit of disruptive innovation. The practitioners involved in this research demonstrated that their organisational memories prejudiced their innovation activity. It could be concluded that investment options which are congruent with organisational memory are less likely to create cognitive dissonance than options that require the

treading of new ground – such as disruptive innovation. The senior management teams within these established businesses possessed a shared management psychology entrenched in organisational memories that appeared to create a limiting filter, which younger organisations do not possess. Instead younger or emerging organisations are more agile (Tushman and O'Reilly, 1996) and appear more prepared to adopt notions that support disruptive innovation such as "win small, win early and win often" and "be patient for growth but impatient for profitability" (Hamel, 2000; Christensen and Raynor, 2003), as presented in Chapter 4.

The discovery of this disruptive innovation rejection strategy and the insights presented above were used to generate the following propositions:

An executive management team who is committed to the pursuit of disruptive innovation must ensure that their top management team, and the key stakeholders in the innovation effort, are accepting of the notion that all technologies, customer offerings and business models have limited life cycles. In doing so, they must ensure the top management team's 'sense making' activities are open to both sustaining and disruptive innovation and are dominated by what the business could do, as opposed to what it has done in the past.

The combination of this research with extant literature from the area of disruptive innovation shows that organisations must embrace the notion that history is to be celebrated but not allowed to dictate the future. Thus, if an organisation has committed to the pursuit of disruptive innovation and an employee allows their unwillingness to accept this notion to inhibit the pursuit of this strategy, then their departure from the business should considered. Company Chairman should pay particular credence to this proposition if such an employee happens to be the CEO or a director - as the 'upper echelons' exert significant influence across the business. Although it may seem a little draconian, this notion has received support since Pfeffer and Salancik (1979) made a very similar assertion in their work on the impact of resource dependencies.

7.2.2.4 Rejection Strategy 4: Creating perception of success with high effort

The more effort that is seen to be put into sustaining innovations the more management practitioners will try to perceive the outcome as desirable. This allows management to add consonant cognitions to such organisational behaviour and explains the maintenance of the preference for sustaining innovations in two ways:

(1) they contribute to the grand historic effort of the business, and

(2) they are more likely to immediately require large amounts of resources and aim to deliver some measurable immediate benefit than a new potentially disruptive opportunity (which will be focused upon small market niche), thus increasing the perception of contribution and comprehensiveness

Evidence in the data, linked to the amount of effort expended on current innovation initiatives, points to another cognitive strategy employed by practitioners to reduce the cognitive dissonance surrounding disruptive innovation (thus legitimising the allocation of resources to sustaining innovations). Participant from both cases A and B cited examples of "prestige innovation projects" where huge amounts of effort were being invested. The targets of the high-activity, prestige projects were nearly always the improvement of highly mature products and/or technologies for familiar markets. The data analysis revealed a correlation between the amounts of reported effort, which management teams had invested into their prestige projects, and the perception of attractiveness of the outcome of this resource allocation.

In case A, for example, resources invested into prestige projects were targeted at improving core offerings, to retain market share and to remain competitive with insurgent Chinese rivals. It was observed that the practitioners, in the face of growing year on year competition, commit more and more effort, yet achieve less and less benefit. Despite this performance analysis, which illustrates that such project teams had reached the point of diminishing returns, senior management appeared keen to exaggerate the benefits of their high effort projects, both in their own minds and to the rest of the business. In both cases the more effort the management teams had invested into their prestige projects, the more they sought to exaggerate the attractiveness of the outcome of this resource allocation. Perceived attractiveness was, therefore, linked to effort and appearance and not always to measured benefits. The perception of exaggerated attractiveness provides insights into the cognition of practitioners faced with the choice of funding a project of a sustaining or potentially disruptive innovation. The investigation has found that the experience of cognitive dissonance, generated by the incongruence of potentially disruptive investment options, can be alleviated by deciding to fund the unjustly attractive, but perceptually desirable, high-effort sustaining innovation and rejecting the potentially disruptive alternative.

Once again the discovery of this disruptive innovation rejection strategy has important implications for executive management teams. As such, a proposition can be immediately drawn: An executive

management team, which seeks to pursue both sustaining and disruptive innovations, may be blinded by the effort involved in an innovation initiative if they do not intervene with how success is measured in their organisation. Particular attention must be given to uncovering false perceptions of success attached to high-effort projects that are delivering diminishing returns on investment.

Discussing the validity of this finding:

The strategy of linking the perception of success with high effort was presented and discussed with the wider collaborative research group. Despite some initial hesitancy, the participants 'admitted' that they, or other members of their organisations, had allowed their perception of success to be governed by how much effort had been undertaken. This false perception of success was reported to increase the cognitive consonance surrounding the decision to reject or withdraw funds from potentially disruptive innovations in favour of their sustaining alternatives. Thus, the existence of this disruptive innovation rejection strategy has been ratified by a wider group of industrialists.

The emergent understanding of this disruptive innovation rejection strategy further contributes to the body of knowledge surrounding the topic of 'managerial comprehensiveness' (Fredrickson, 1984; Fredrickson and Mitchell, 1984 – as described earlier in this chapter). For example, most managers are used to working in operational contexts that strive to maintain or enhance their current businesses with sustaining innovations. This situation necessitates the need for high levels of comprehensiveness; a factor that becomes engrained into working processes, culture and the perception of success (Fredrickson and Mitchel, 1984). Thus, when attempting to deliver competitive advantage with innovation, managers who are entrenched in the notion that high levels of comprehensiveness will deliver success, may be more likely to initiate and fund high effort, high involvement, low risk sustaining innovation projects. The evidence and literature presented through-out this thesis has shown that such an approach is unsupportive to the pursuit of disruptive innovation. Early stage success should not be measured in terms of high effort. Instead it should be considered in terms of linking a unique proposition to a small niche market with a compelling reason to buy that also has high potential for providing the basis of a disruptive foothold market.

Moreover, and perhaps more pertinently, experiments from the field of social psychology, which have considered cognitive dissonance, can also be linked to this disruptive innovation rejection

strategy. For example, Aronson and Mills (1959) conducted an experiment whereby women had to undergo a severe or mild 'initiation' to become a member of a group. In the severe-initiation condition, the women were made to engage in an embarrassing activity to join the group, whereas the women in the mild-initiation condition joined the same group without engaging in the embarrassing activity. The group that the participants joined was engineered to be rather dull and boring. When the women had been group members for a short while, interviews were conducted and it was found that those which had undergone the severe-initiation evaluated the group more favourably than those who had experienced the mild-initiation. Beauvois and Joule (1996) have noted that prior to this, social psychologists would have predicted that the greater the unpleasant effort required when obtaining an outcome, the greater the perception of cognitive dissonance. However, Aronson and Mills (1959) claim that this did not occur, with their participants from the severe-initiation condition, because their research shows that humans have a tendency to actively attempt to reduce their perception of dissonance by adding consonant cognitions to their behaviour, thus exaggerating the desirability of the outcome. Beauvois and Joule (1996) refer to this phenomenon as the effort-justification paradigm and it continues to be used fruitfully in social psychology research today (Harmon-Jones and Mills 1999).

In sum, the effort-justification paradigm effectively asserts that the more effort people have to put into an activity the more they will seek means to exaggerate the desirability of the activity's outcomes. This has clear resonance with the disruptive innovation rejection strategy that was observed to occur within the case studies involved in this research. Therefore, it is believed that the current investigation has contributed to the body of knowledge on the effort-justification paradigm, via the provision of another context of incidence that has not hitherto been rigorously explored.

Consideration of the findings and the literature presented above led to the generation of the following proposition:

If executive management are committed to the pursuit of both sustaining and disruptive innovation they should ensure that they, and their management teams, are not blinded by high-effort innovation initiatives. They should introduce mechanisms to deliver a true picture of realised or realisable benefits. Such a picture would demonstrate the innovation options contribution to emerging, growing and maturing customer offerings and business models, as well as strategic goals - not just bottom line profits.

7.2.2.5 Rejection Strategy 5: Holding beliefs in the face of disconfirming information

Cognitive dissonance will be stimulated by the presentation of a potentially disruptive opportunity if it is *inconsistent* with prevailing organisational trajectories and/or executive management's beliefs. The experience of such psychological discomfort can compel managers to hold onto their familiar beliefs, to misinterpret the potentially disruptive opportunity, and to reject it as a viable investment option.

The management practitioners in both Cases A and B appeared to hold beliefs that were unchangeable in the presence of disconfirming information. Case B, for example, had identified a potentially disruptive business *opportunity in an unfamiliar* market. They had managed (on this occasion) not to succumb to the previously mentioned rejection strategies and a development project had been initiated. Members of their senior executive team kindly agreed to share their potentially disruptive concept with the author, for the benefit of the current research and in return for a workshop that introduced a summary of best practice *guidance* and advice on the implementation of disruptive strategies, from academic literature. Concordantly, a one-day interactive workshop was designed and implemented with the project management team and a cross functional support group from other areas of the business unit. There were 32 participants in total who took part in the 'state-of-the-art knowledge transfer activity'. On concluding the workshop, 80% of the group who were non-project members reported that the day had contributed "high benefits" to their professional development, and their understanding of disruptive innovation (20% *medium-to-high* benefits). All of these people reported that they believed the theories discussed would help the project succeed. Conversely, 80% of the project team's members reported their disappointment with the notion that disruptive innovations should be initially launched with comparatively small projects for specific niche markets. Moreover, the distinct majority of the senior members of the project team *dismissed the information* and sought to persuade other participants within the workshop to do the same. They reported that they believed in the potential of their concept so much, that they chose to ignore the disconfirming information and still wanted to launch a multi-million dollar, 5-10 year project. They hoped that the result of this project would be able to compete directly with industry incumbents in the mainstream market, effectively using a mass market sustaining innovation model – thus the project management team had also succumbed to rejection strategy 4. Therefore, another strategy employed in both cases A and B was

simply the dismissal, refutation and/or misinterpretation of information that was inconsistent with the beliefs of the practitioners.

Of the participants involved in this research that struggled, failed or refused to accept the notion of disruptive innovation, all could be considered as intelligent and diligent industrialists who wanted the best for their organisation. So why would they hold on to their beliefs in the face of disconfirming information? Reporting upon cutting edge consumer research techniques, Spinney (2004) states that there is an "instinctual response to overvalue something when we see that other people want it... it makes sense for us to be swayed by others in this way because much of our success as a species depends on our ability to learn what is good and what is not from those around us." (p34). Thus, when the bulk of influential people within an organisation purely focus upon sustaining innovation, it is difficult to resist this majority. And in the absence of an active community of practice within both cases A and B, which could influence their management practitioners into using the disruptive innovation management approaches from the literature, it should come as no surprise that the theory was rejected by some.

The existence of this disruptive innovation rejection strategy has important implications for executive management teams. As such, a proposition can be immediately drawn from this finding: executive management should attempt to uncover the deeply entrenched beliefs that undermine the pursuit of innovation that moves beyond the steady state. In doing so, they will be better prepared when propagating the notion of disruptive innovation.

Discussing the validity of this finding:

The strategy of holding beliefs in the face of disconfirming information was presented and discussed in a workshop setting with senior management practitioners from the wider collaborative research group. The participants reported that information, which is incongruent with their organisational beliefs, can generate psychological discomfort (associated with the experience of cognitive dissonance) leading to its rejection. Thus the existence of this disruptive innovation rejection strategy has been ratified by a wider group of industrialists.

When considering the example, presented above, of members of Case B holding beliefs in the face of disconfirming information, perhaps Reagans and McEvily's (2003) insights into knowledge transfer could be useful once again. It could be argued that the author struggled to permeate the external and internal boundaries of the case study organisation because he only established weak ties between the sources of information and the recipients. However, feedback would suggest to

the contrary and, furthermore, investigations from the field of social psychology (in particular cognitive dissonance) can be extrapolated to provide insights into this disruptive innovation rejection strategy.

Burris et al. (1997) investigated cognitive dissonance in the context of religion. They demonstrated that people are willing to act by faith alone and not change their behaviour when presented with information that is inconsistent with their beliefs. It was shown that people will hold on to their beliefs and misperceive or misinterpret disconfirming information, which consequently, leads to it being refuted or rejected. It was also reported that these people sought support from other "believers", in their endeavours to maintain a sense of self that is both consistent and positive. Harmon-Jones and Mills (1999) have stated that this phenomenon can be referred to as the belief-disconfirmation paradigm.

Thus, it would appear that the current investigation contributes another context to which the belief-disconfirmation paradigm is applicable. Once again, the area of social psychology offers further understanding and support for the notion that managers may reject or refute innovations with disruptive potential. Thus, when pursuing resources for potentially disruptive opportunities, management practitioners need to be aware of the fact that people may be holding onto their beliefs in the face of disconfirming information. Industrialists will, therefore, benefit from developing strategies to overcome the effects of prevailing beliefs, especially when presenting data that suggests current competitive advantage, technological platforms, customer offerings or business models have limited life cycles.

Another reason as to why members of the case studies involved in this research may have held on to their beliefs, in the face of disconfirming information, can be found by considering the organisations' origins. Tripsas and Gavetti (2000) state "Work on organizational imprinting has demonstrated that a broad range of environmental conditions at organizational founding (e.g. the social, economic, and competitive environments) have a lasting influence on organizational structure and culture" (p1159). It is their belief that the area of organisational imprinting should be a new avenue of investigation for those conducting research into discontinuous and disruptive innovation. For example, Tripsas and Gavetti (2000) believed the role of Polaroid's founder was significantly influential over both its success and its eventual demise. This notion is supported by Schein (1983), whose research also demonstrated that not all founders are as memorable, and therefore do not have such a significant effect. Stinchcombe, (1965) has discussed social structures at organisational founding and Zygildopoulos (1999) has investigated initial environmental

conditions. Both authors' work show how these settings can induce limiting factors on future trajectories of development. Furthermore, Burgleman (2002) demonstrates how difficult it is for management practitioners to overcome the organisational 'inertia of evolutionary lock-in'. Alternatively, Adams' (2002) work as a venture capitalist has led him to believe that organisations which start life with an entrepreneurial and adventurous culture, are more likely to continue to be entrepreneurial and adventurous in the future.

It is not in the remit of this research to investigate, at length, each case study's founding, yet it could be seen that the conditions at each organisation's beginning may have possibly locked them into a trajectory of development, limiting them to sustaining innovation. Although not demonstrable in the context of the current research, this discussion does lead to the conclusion that management practitioners wishing to pursue disruptive innovation may have to consider 'organisational imprinting' before they commence. This may allow them to assess the extent to which organisational members will hold onto prevailing beliefs regarding their organisation and their innovation activity. Such a consideration could allow managers to calculate how to 'pitch' the pursuit of a potentially disruptive innovation when building a community of interest, making requests for resources or attempting to modify the strategic intent of the organisation.

Consideration of the findings and the literature presented above led to the generation of the following propositions:

Executive management, who want to initiate a focus upon the pursuit of disruptive innovation, should assess the extent to which their organisation's founding contributes to the organisational wide view of its future. In doing so, executive management will identify the stakeholders who will be resistant to the re-focusing of selected resources to potentially disruptive innovations. Furthermore, this will enable them to work on the delivery of tailor made education packages to garner the support of pockets of resistance (NB. a holistic understanding of the innovation playing field, such as that delivered by the DPM intervention, could be useful in this context).

A management practitioner, who attempts to attract funding for a potentially disruptive innovation, which is counter to traditional organisational focus, should be prepared to face the belief-disconfirmation paradigm. Thus, the management practitioner should pre-emptively prepare mitigating strategies such as creating a network of influence or pitching the idea in the language of the prevailing doctrine.

7.2.2.6 Discussing and positioning the contribution to knowledge made by the identification and exploration of the disruptive innovation rejection strategies

- Locating the contribution of the findings to the understanding of theory and practice of resource allocation:

Further consideration of the *disruptive innovation rejection strategies*, and their cognitive basis, appears to reveal that they not only underpin common inhibiting management actions (Section 7.2.1), but they appear to be the primary reason for managers' failure to allocate resources to potentially disruptive innovations throughout all resource allocation activities (Figure 7-4). The collaborative partners involved in this research have concurred with this notion. It can be seen that prevailing mental models were affecting the structural context (the management systems, the allocation of physical resources) and the situational context (the cultural systems and individual and group values) within all the collaborating case studies. Consequently, cognitive dissonance was experienced at all points within the activities that can be described as within the remit of resource allocation.

Chapter 5 (Section 5.6) presented an overview of the literature pertaining to the resource allocation agenda faced by today's management practitioners. An outline was provided regarding the decision making context, the requirements for a continuous process, a breakdown between resource approval and resource provision, and the identification of some of the primary supportive management tools and approaches. It is believed that the findings of the final wave of this research contribute to furthering the understanding of a breakdown between resource approval and resource provision and the decision making context within which this occurs. For example, Burgleman et al. (1996); and Leonard-Barton (1992) provide a description of the decision making context faced by management with responsibility for allocating resources. It is believed that this thesis adds further richness to their work by contributing increased academic clarity to the resource allocation issue, by offering a better understanding of the effects of conflicting management cognitions (Figure 7-3). Moreover, insights are garnered for management practitioners wishing to initiate the pursuit of disruptive innovation.

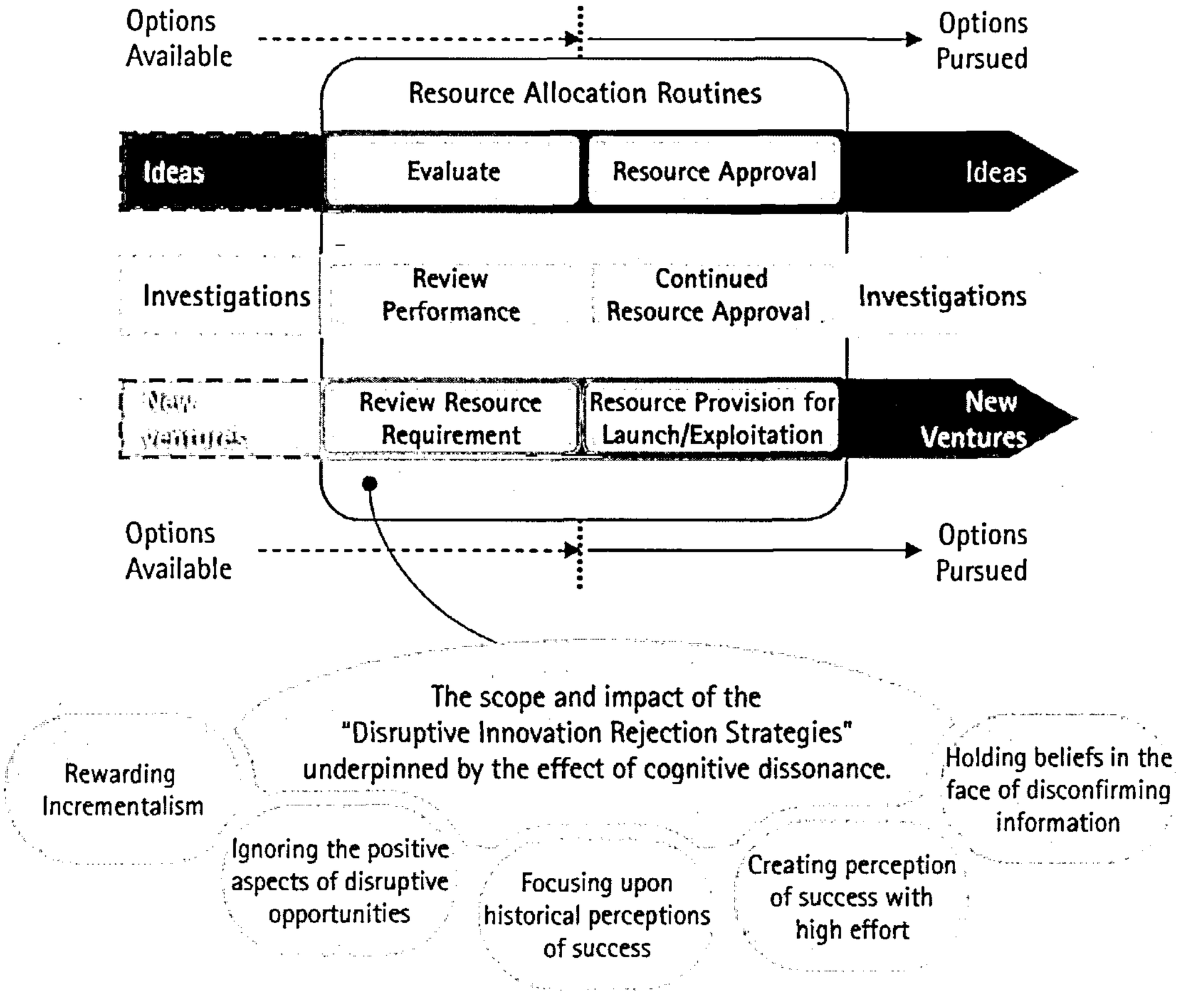


Figure 7-3: Cognitive dissonance and disruptive innovation rejection strategies: their impact upon resource allocation routines.

Stacey (2000) and McMillan (2004) discuss how shadow systems, such as the 'underground' conversations that organisational members partake in on a daily basis, affect the strategic action of an organisation. By considering the rejection strategies as a negative shadow system the above conclusion has further implications for the depth and breadth of the impact of cognitive dissonance. If it is accepted that the resultant disruptive innovation rejection strategies play a significant part in limiting the output from both the structural and situational contexts of resource allocation, then they may not only underpin inappropriate resource allocation routines. Their impact could be mapped across the entirety of the processual and systemic elements of the innovation effort. Figure 7-4 extends the 'scope of resource allocation diagram' to include the processual elements of innovation, and shows that the impact of cognitive dissonance could quite easily be a major contributor to all barriers in the pursuit of disruptive innovation.

The conclusion from this assertion is that the impact of cognitive dissonance is likely to be common in all average performing businesses but will have to be dealt with in a bespoke manner to deal with the intricacies of individualised approaches to the innovation effort. Strategies for reducing risk (e.g. probe and learn tactics, staged funding, partnering etc) may be difficult to deliver until the prevailing restrictive mental model(s) are acknowledged and understood.

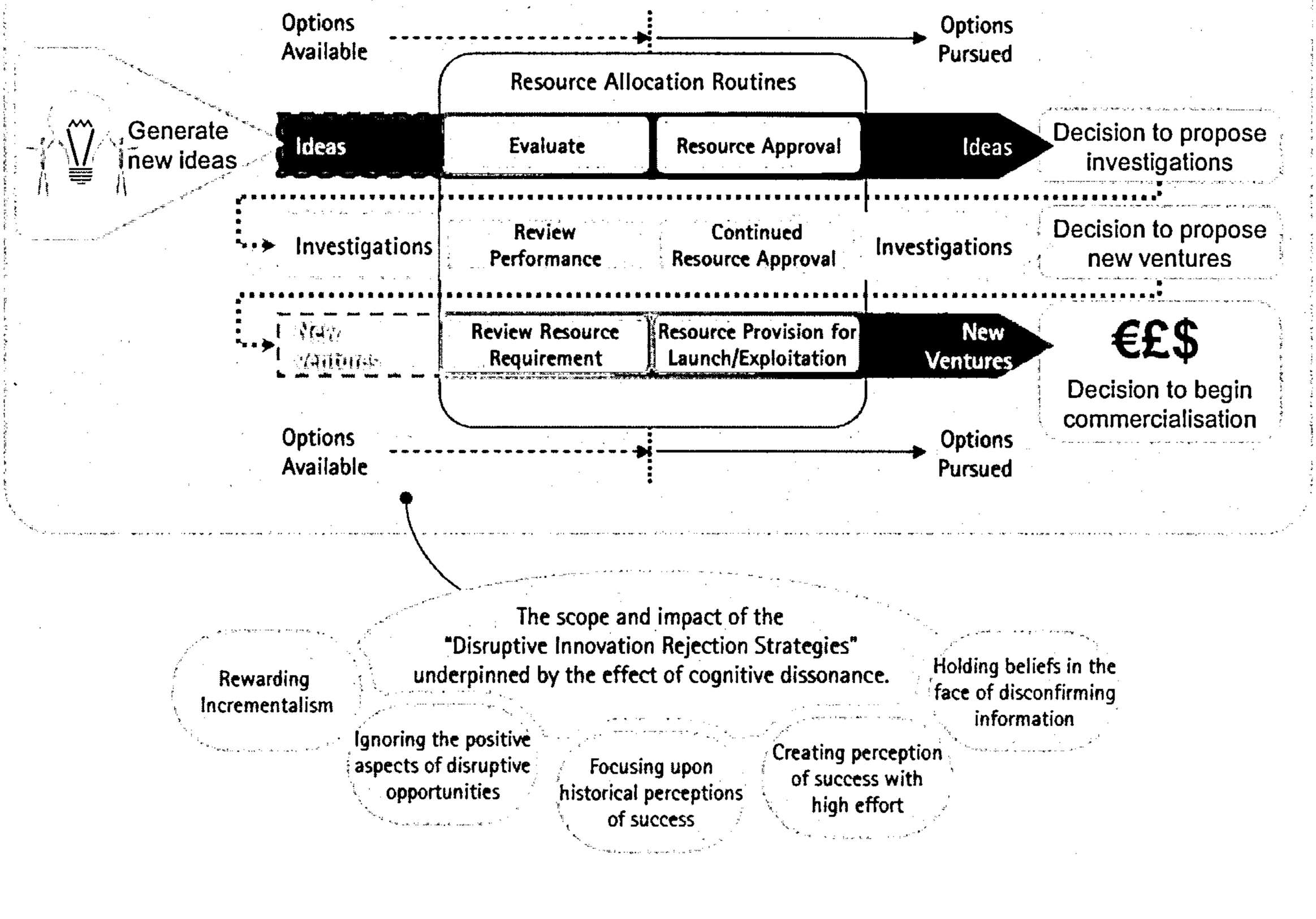


Figure 7-4: Cognitive dissonance and disruptive innovation rejection strategies: their impact upon the entire innovation effort.

It may be possible to extend this finding yet further by considering the five rejection strategies as a root cause for the rejection of all ideas and concepts that are incongruent with prevailing mental models, not just disruptive innovations. If this was so, we would expect to see the emergence of

these rejection strategies in the contexts of most large change programmes, the forcing of compliance to governmental policy, and in the introduction of agendas that do not immediately add to an organisation's bottom line i.e. 'green' issues and social corporate responsibility. Interestingly, Reger et al. (1994) report that many total quality management (TQM) programmes often require the managers to reframe their image of their organisations and even their roles within. Consequently, "... implementing total quality is easier said than done" (Ibid p566); TQM was often reported as being contradictory to established patterns of work, met with resentment and even, in some cases, aborted. The researcher hopes that the effect of prevailing mental models and cognitive dissonance can be extend to broader fields of organisational change.

- **Considering the pursuit of disruptive innovation at the micro-level - a contribution to understanding from the perspective of management cognition:**

Kaplan et al., (2003) note that the body of literature in the arena of innovation management and in particular the field of discontinuous innovation "... in general, has not focused attention on management's cognitive processes" (p230). And as stated previously in this thesis, Tripsas and Gavetti (2000) call for more research into managerial cognitions. They state that a better understanding of the cognitions that drive management behaviour must be uncovered, when considering a management team's willingness and ability to adopt the pursuit of strategies that could be thought of as disruptive. However, Christensen and Raynor (2003) note that it is difficult to understand the cognitions (or thoughts and believes) that underpin a management team's ability to succeed or fail with disruptive innovation. Yet, the work of Salvato (2003) and Johnson, Melin and Wittington (2003) could suggest that such difficulties may be overcome by understanding an organisation from the perspective of micro-strategy; where micro-strategy is said to be the established system of interconnected routines and micro-activities.

The data underpinning the discovery of the five disruptive innovation rejection strategies (as presented above), is based upon the researcher's observations, and statements from participants in relation to the micro activities and cognitive routines that underpin management decision making in the practice of innovation. The discussion of each disruptive innovation rejection strategy, in relation to innovation literature and findings from social psychology, knowledge management and organisational learning, has provided further richness to the emergent importance of managerial cognition and the effect of experiencing cognitive dissonance. Thus, it is believed that this research

has contributed, via the identification and description of the five disruptive innovation rejection strategies, to a better understanding of the managerial cognitions that result in an organisation's failure to foster disruptive innovation.

As well as linking the topic of disruptive innovation to the previously overlooked constructs of cognitive dissonance and mental models, this research provides a new context of application for these terms from social psychology. Much of the past research into cognitive dissonance has been of the experimental type, *in laboratory* or staged settings (Harmon-Jones and Mills, 1999), which restricts the real-life element of the investigations (Robson, 1993). And mental models are often referred to in difficult-to-apply abstractions or in an over-simplified manner (Hodgkinson, 2000). Thus, the context of application - the pursuit of disruptive innovation - explored by this research, offers social psychologists and social scientists a *real life setting and a new window* through which they can consider the effect of cognitive dissonance and mental models. For this reason it is believed that this thesis, with its deeper probing of the effects of cognitive dissonance and mental models, contributes a new angle to the growing field of micro strategy and strategising with an activity based view (Johnson, Melin and Wittington, 2003). And in doing so it begins to answer the calls of Tripsas and Gavetti (2000) and Kaplan et al., (2003) for a better understanding of management cognitions.

- **Considering the pursuit of different types of disruptive innovation:**

As noted in Chapter 2 (the literature review), there are different approaches to the pursuit of disruptive innovation and the level of disruptiveness is not experienced to the same degree by all stakeholders. When considering the data set that underpins the disruptive innovation rejection strategies, with this appreciation in mind, a clear observation was noted: cognitive dissonance was reported to be experienced by managers from all four established cases when a potentially disruptive innovation conflicted with an established mental model. However, the speed at which the disruptive innovation rejection strategies were engaged was observed to vary. Potentially disruptive *innovations* that require the development of new, simple technological capabilities, appear to be met with less resistance than those that require the adoption of different strategic beliefs. The latter appeared to immediately generate significant levels of cognitive dissonance and were almost immediately confronted with the disruptive innovation rejections strategies; whereas

the former appeared to be influenced by the rejection strategies to an increasing degree as they progressed through the innovation processes.

This observation can be presented by considering the different intensities with which the Cases A and B employed the rejection strategies and why. For example, Case A, the medium sized manufacturer, appeared to be more susceptible to the dissonance caused by disruptive opportunities that could potentially effect their core business operation. It appeared that this increased susceptibility was mainly due to their experience with and reliance upon a narrow group of technologies and narrow range of product offerings. Alternatively, once the management team of Case B, the large manufacturer, accepted the notion and importance of disruptive innovation they appeared to be more open to the suggestion that they could, and perhaps should, disrupt aspects of their core operations. This acceptance primarily appeared to be due to their large experience with a significantly diverse technology base, where experimenting with technologies was a key business activity. More research is needed to consider the relationship between the susceptibility of dissonance and the breadth of technological activity, yet it seems clear that the rejection strategies will be pursued with more vigour when cognitive dissonance is immediate and intense.

This observation has also been paralleled by reports of management action in the literature. For example, Chandy and Tellis (1998), note that taking the first steps to disruption, via self-cannibalisation, often requires significant shift in strategic action and this is why many executive management teams resist or reject innovation of this sort. Likewise, Tripsas and Gavetti (2000) show that radical technological discontinuities, in the photography industry, had failed to cause a transformation in the basis of competition for Polaroid's core markets, until the emergence of digital imaging. This technological discontinuity represented a change that required a fundamentally different strategic belief. Polaroid's own digital imaging group pushed for a change of strategic focus, yet their ideas for new business models were resisted and rejected by top management. It could be argued that unperceivable disruptive innovation rejection strategies were at play within this one time world leader. In fact, Tripsas and Gavetti (2000) call for more research into management's understanding of, and reactions to, discontinuities that require the development of new technological capabilities versus those that require the adoption of different strategic beliefs. Moreover, 6 of the 11 expert interviewees made reference, without being prompted, to the increased propensity for top management to reject potentially disruptive ideas, if they appeared to instantly conflict with prevailing beliefs/mental models.

The identification of five disruptive innovation rejection strategies has provided managers and academics with the ability to consider the failed pursuit of disruptive innovation at a micro level. In doing so, it has been found that the higher the perceived intensity of disruption (e.g. a need for a change in strategic belief), the faster and more intense the disruptive innovation rejection strategies emerge.

7.2.2.7 Summarising the limitations of insights that can be drawn form this deeper understanding

To effectively summarise the limitations of insights that can be drawn form this deeper understanding it is necessary to highlight the strengths and weaknesses of the approach taken to this investigation (Table 7-2).

STRENGTHS

- The findings are grounded in a real world investigation with data from four organisations that are attempting to use innovation to pursue increased competitive advantage.
- The findings in this thesis have been evaluated by the industrialists involved in this research as having a high degree of relevance.
- All data analysis activities have been triangulated with data from 'expert' interviewees, from outside the research group, and extant literature, in order to prevent the temptations of 'going native' (Van Maanen, 1988).
- The research was designed as an exploratory study, aiming to garner data upon the often overlooked qualitative issues of innovation management with respect to disruptive innovation. Such research requires context-specific understanding and the methodology was designed accordingly.
- The research has generated findings of value to both academia and industry; Chapter 8 will summarise how these form the basis of new contributions to knowledge, which can and should be the subject of future investigation to more accurately deduce their reliability and validity.

POTENTIAL WEAKNESSES

- The qualitative nature of the research, with its limited numbers of case study organisations, means that the findings cannot be assessed by traditional, statistical measures of reliability. Thus, the value of the findings, in terms of their generality, results from their degree of credibility to those with an interest in the research area (Wyatt, 2001)
- The nature of qualitative research generates outcomes that cannot be viewed as facts or objective truths; they are the result of an interaction between the research and the researched (Silverman, 2000).
- The findings in relation to the conceptual framework and resource allocation do not represent complete theories, but they do highlight aspects of great relevance to those involved.
- The extant theory on the subject of disruptive innovation has not been tested and validated; it has been explored, in order to develop new knowledge and understanding of the experience of the pursuit of disruptive innovation within today's organisations.

Table 7-2: the strengths and weaknesses of the approach taken to this investigation

The discussion thus far has presented several deeper insights, implications and contributions to theory on disruptive innovation and the practice of managers in today's organisations. Table 7-2 summarises that the nature of this qualitative investigation has enabled in-depth context-specific understanding to be developed regarding the human issues of a research topic that quantitative research cannot deliver. Yet this approach restricts traditional measures of reliability and the push for generalisations; therefore, the value of the findings, in terms of their generality and validity, results from the degree of credibility to those with an interest in the area. It is believed that the author has maximised his opportunities to ensure that rigorous data collection and analysis techniques were implemented and that he accounted for the potential temptations of researcher bias or unjustified participant influence. In this regard, the findings offered throughout this thesis can be asserted as valuable to both academia and industry; they can form the basis of new contributions to knowledge and should be the subject of future investigations to deduce generalisability, reliability and validity.

7.3 Methodological contributions

Authors from the field of qualitative, social science research design, such as Silverman (2000), Robson (1993) and Yin (1994), state that the validity of a research methodology can be assessed in two key ways:

a) Has the methodological approach been designed with full systematic consideration of all the options available?

b) Was the methodology implemented correctly and appropriately?

By answering these questions a full evaluation of the methodology that was employed to satisfy the research objectives of this investigation was conducted. This enabled the final key research finding to emerge, with respect to the collaborative mode 2 approach to management investigations; it is this evaluation and finding that will be discussed in the remainder of this subsection:

> The mode 2 collaborative approach enables researchers to deliver academically robust research without sacrificing the industrial relevance. The collaborative academic-industrial approach can be further facilitated by the exploitation of three features, which are additional to those presented in the extant literature.
>
> i) The pursuit of an open and trusting work environment.
>
> ii) The use of large-scale graphical facilitation approaches to record and disseminate data, and to elicit public commitment to research actions.
>
> iii) The co-creation of a conceptual framework to describe the research area of interest, in order to develop a shared language and to enable a shared research agenda with two-way connections between academia and industry.

7.3.1 A justified methodological approach?

New and Payne (1995:75) state that "It is possible to have academic research which scores high on rigour and cleverness but low on connection to real problems..." and they claim that in management, more than any other discipline, there is a fundamental need to make a "... commitment to an encounter with that which management and workers do..." (p75). The research was designed to account for this issue, ensuring immersion into the world of each case study and a qualitative connection with the issue at hand. A case study based, 'mode 2', academic-industrial,

collaborative research design was employed. Chapter 3 and Appendix 2 describe the systematic consideration of the strategic and practical options, which social scientists face, when conducting a qualitative exploration, from a phenomenological perspective, in an emergent research area. It is believed that this systematic consideration, adequately justified the chosen methodology as the most appropriate research design in relation to the research objectives and time and resource limitations.

7.3.2 Was the methodology implemented correctly and appropriately?

To assess whether or not the mode 2 collaborative research approach was implemented correctly, eight factors were assessed; these were taken from the four features that typify the Mode 2 approach (Stewart et al., 2000) and the four theoretical propositions of idealistic collaboration (Gray, 2004). The findings of this analysis can be seen in Appendix 8. In sum, despite the 'fad-like' nature (Gray, 2004) of this collaborative research (due to the imposed time restrictions), it is believed that this investigation has delivered a high quality collaborative inquiry that has resulted in industrially relevant and academically robust findings. The fact that both the academic and industrial communities have benefited from their involvement, is a key measure that this Mode 2 approach was a success.

Furthermore, as the notion of the Mode 2 collaborative research approach is relatively novel in the area of management studies (Tranfield, 2002), there are gaps in knowledge regarding advice and good practice for researchers. Thus, the author asserts that researchers who have effectively implemented a mode 2 collaborative research design, should look to their experiences to offer a contribution to knowledge and practice, which have not been promoted else where, regarding collaborative academic-industrial methodological approaches.

At the closure of the research activities the following four main contributions were drawn:

1) **Building an environment of trust with a no-competitive research group and team building activities:**

   It is believed that a researcher driven collaborative approach can only be effective if the industrialists are trusting and open, both with the researcher and the whole team of industrial collaborators. This was especially important in data collection workshops involving the entire group, where participants were required to share personal thoughts and company practice on innovation. Thus, it is believed that the use of case study sites from disparate organisations (creating a non-competitive research group) combined with

the use of team and trust building activities (proposed and implemented by each of the different organisations within the group) proved essential in the rapid development of trust and openness.

2) The use of large-scale graphic facilitation:

At the end of each wave of the research, data were gathered in the form of participant feedback. Following analysis, it appears that the use of the graphical facilitation approach (as described in Chapter 3) was believed to assist with the collaborative approach to the investigation. As well as delivering a fresh new way of displaying, collecting and analysing information (Young, 2003), six main benefits were cited:

- They improve the efficiency of transferring and developing knowledge and understanding.

- They improved communication within the heterogeneous group of both academics and practitioners - thus enabling a true trans-disciplinary investigative approach - by surfacing a common language within the research group and increasing the levels of construct equivalence surrounding terminology and shared experiences.

- They provided another medium for the participants and the author to better communicate how the research problem ('How can organisations understand and foster disruptive innovation?') was framed in the context of application within the case study sites.

- They facilitated the surfacing of information and data that would have otherwise been significantly more difficult to extract; a finding also noted by Young (2003).

- When used effectively, they appeared to mandate full participation from the group.

- They enabled the group to develop, agree and utilise a socially-distributed research capability. The graphical approach facilitated public commitment to, and improved the communication of, actions, knowledge and insights (e.g. tasks and actions were easily shared amongst all group participants using large scale graphical 'pert charts' or 'responsibility maps').

3) The academic and industrial co-development of a conceptual framework that holistically describes the research area under consideration:

The co-development of the conceptual framework that emerged from the first wave of research activities has provided significant utility for both the academic and industrial audiences – a key indicator of successful 'mode 2' collaborative design (Tranfield, 2002). It contributed to the holistic academic understanding of disruptive innovation in the context of the larger agenda of innovation research (Thomond, Lettice and Herzberg, 2003). And it contributed to the management practitioner audience in two ways. Firstly, by explaining the multifaceted and interrelated features of disruptive innovation in a pragmatic and holistic manner. Secondly, it has been shown to be a value added tool to assess and compare organisational performance (e.g. Michel, Monville and Thomond, 2004).

4) **Conscious effort to build construct equivalence regarding research terms:**

The importance and benefits of the graphical nature of the conceptual framework were further extended by the mode 2 research design; they were also influential in the design of the DPM management intervention. For example, the graphical and conceptual synthesis of a holistic understanding of the topic surfaced a common language that underpinned the essential feedback and two-way connections between the academic and industrial communities. Thus the conceptual framework generated a protocol that authors such as Gibbons el al (1994) view as essential in collaborative research. They state that successful collaborative research is "... characterised by a constant flow back and forth between ... the theoretical and the practical... discovery occurs in contexts where knowledge is developed and put to use, while results, which would have been traditionally characterised as applied - fuel further theoretical advances" (Gibbons et al., p9, 1994). Thus, the graphical nature of the conceptual framework helped to solidify 'construct equivalence' (Welkenhuysen-Gybels and Van de Vijver, 2001) this facilitated shared understanding and minimised difficulties with academic and organisational specific definitions of complex terminology.

It is believed that the instruments and protocols developed throughout this investigation offered the author an opportunity to simultaneously seek relevance without sacrificing rigour through a collaborative research design. As a consequence these insights are offered as a contribution to knowledge and practice.

7.4 Summary

It is believed that in light of the valid and robust design of the research methodology and management intervention, the findings presented in this chapter can be accepted as relevant and valuable to both academia and industry:

Therefore, it may be possible to conclude that a top management team, of an average performing organisation, can begin to overcome its resource allocation barriers to disruptive innovation if the following four circumstances were present:

a) They had an understanding of the importance of disruptive innovation.

b) They could map their priority innovation activities onto a holistic view of the entire innovation playing field (a view that includes areas for both sustaining and disruptive innovation).

c) They were facilitated to see how both mechanistic financing routines and a restrictive perception of innovation, constrain resources and generate a failure to support disruptive opportunities (thus providing a value based view of why innovation projects, with disruptive potential, have been killed in the past).

d) They were facilitated to see how it is possible to challenge existing restrictive funding routines and to allocate resources to potentially disruptive innovations.

Moreover, the identification of the restrictive management actions and disruptive innovation rejection strategies allows both academics and industrialists to better understand, and to more effectively appraise, problems with the allocation of resources to disruptive innovation. In sum, being capable of fostering and delivering a disruptive innovation is not simply a matter of adding procedures, teams, champions, and visionary leaders (although these factors are important). This thesis provides evidence to illustrate that the pursuit of disruptive innovation may require a shift in the mental models of major innovation stakeholders within an organisation. The investigation found that an holistic appreciation of the entire 'innovation playing field' and an holistic understanding of how current innovation activity maps onto this space, appears to enable top management teams to understand, challenge, and even change prevailing mental models. However, these reconfigurations appear to induce emotive responses especially when they impact self perception, and the perception of prevailing power bases and relationships within an organisation.

These emotive responses induce the application of disruptive innovation rejection strategies which in turn stimulate restrictive management actions.

Thus, if the top management of an average performing organisation commits to delivering and fostering disruptive innovations they must first conduct a review of their resource allocation activities. Such a review must consider both physical systems as well as an assessment of the strength and influence of the top management teams prevailing mental model(s). Indeed, the failure to acknowledge the influence of prevailing belief systems and the impact of cognitive dissonance, both in theory and in practice, may prove to be a key explanation as to why researchers and practitioners do not understand the barriers to the pursuit of disruptive innovation well enough in order to do anything proactively about them.

7.4.1 Recommendations for innovation practitioners

The following recommendations for innovation practitioners have been extrapolated from the findings of this study and the extant literature.

1. An holistic understanding of innovation activity allows management to challenge prevailing mental models that restrict innovation, allowing organisations to disrupt strategically.

2. One method of delivering an holistic understanding of innovation activity can be achieved using the "Disruptive Portfolio Management" approach designed during this study.

3. An holistic view of innovation activity improves the quality of management meetings focused upon innovation.

4. Senior executives must reduce the perceived risk of pursing disruptive innovation, first amongst their own team then across the business. Case study organisations involved in this research achieved in by using portfolio maps to complete three key actions:

- The adoption of knowledge on the theory of disruptive innovation and staged financing approaches.
- The recognition of prevailing mental models and an understanding of how they encourage the use of disruptive innovation rejection strategies.
- An holistic view of innovation activity, which can be used to legitimise 'ring-fencing' resources for potentially disruptive initiatives.

5. Ring fencing resources within your portfolio for seed-funding strategies, will support and deliver a patient-for-growth yet impatient-for-profitability approach.

6. The management team must select a team of 'movers and shapers' who understand the theory of disruptive innovation and who can help mould potentially disruptive ideas into disruptive business propositions.

7. Management teams must diffuse knowledge on disruptive innovation throughout the organisation; they can use portfolio map output to communicate support, intent and availability of resources.

8. The discipline of managing the mental models of employees – *surfacing*, testing and improving their internal picture of how the world works – will deliver day-to-day strategically aligned activity.

9. Top management must regularly look at their firm's current customer offerings and ask themselves the following simple questions to ensure that disruptive innovation remains fresh in their mind:

- Are we facing diminishing returns for investments into incremental improvements?
- Are any of these offerings at risk from being disrupted from below?
- Do we have projects in our portfolio to protect the low-end?

10. Top management must regularly look at their firm's current competencies and ask themselves the following simple questions to ensure that disruptive innovation remains fresh in their mind:

- Have we become fixated on our product offerings or our historical success factors?
- Could our current and existing competencies be combined with knowledge on disruptive innovation to offer different markets different offerings?
- Do we have projects in our portfolio to exploit our competencies using new or low-end disruptive strategies?

The following chapter will conclude this thesis by clarifying and asserting the contribution to knowledge made by the research.

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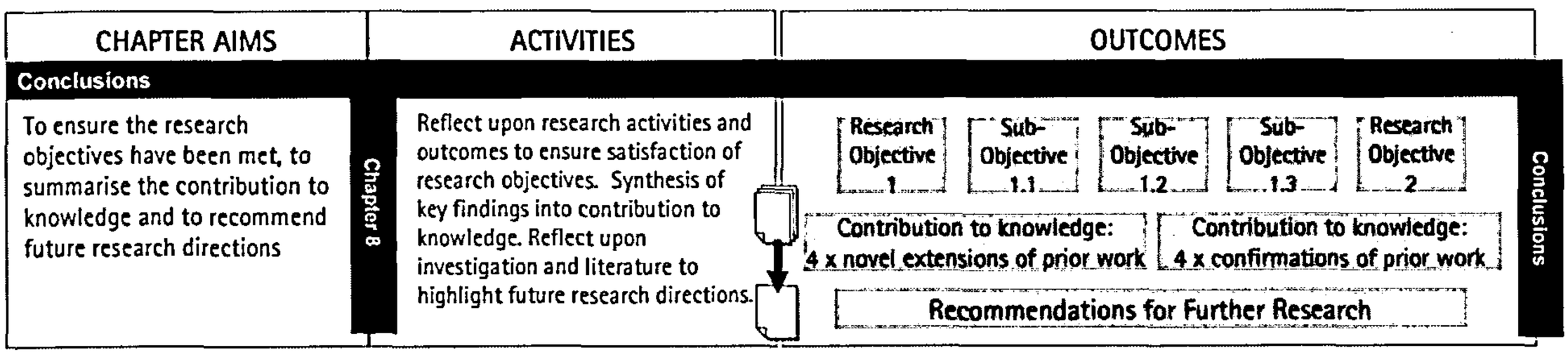
8. Conclusions

This chapter has three aims: (1) to briefly summarise the approach taken by the research to explore the nature and experience of management practitioners' pursuit of potentially disruptive innovations in average performing (or non-best-practice) businesses, (2) to make clear the overall contribution to knowledge made by this research, and (3) to provide recommendations for future research.



8.1 Introduction

This research began with a review of key literature (Chapter 2). The review demonstrated that Clayton Christensen (e.g. Christensen, 1997 and Christensen and Raynor, 2003) was responsible for coining and popularising the terms disruptive technologies and disruptive innovation. Consequently, the literature review provided a critique of Christensen's work, and traced a history of academic publications that focused upon innovation of a discontinuous nature. It was found that authors and industrialists alike have expressed the urgent and growing need for an improved understanding of disruptive innovation and how it can be delivered. Yet, publications and industrial practice appear to fall short of delivering three important factors:

- a clear definition of disruptive innovation,
- an holistic understanding of the topic in terms of the multifaceted and interrelated qualitative issues that surround innovation practitioners' capacity and capability to foster disruptive innovation, and
- an identification of primary issues that average performing businesses must first undertake to initiate their pursuit of disruptive innovations.

This observation spurred the current investigation, which has generated a contribution to knowledge in the area of innovation management. Figure 8-1 illustrates this process.

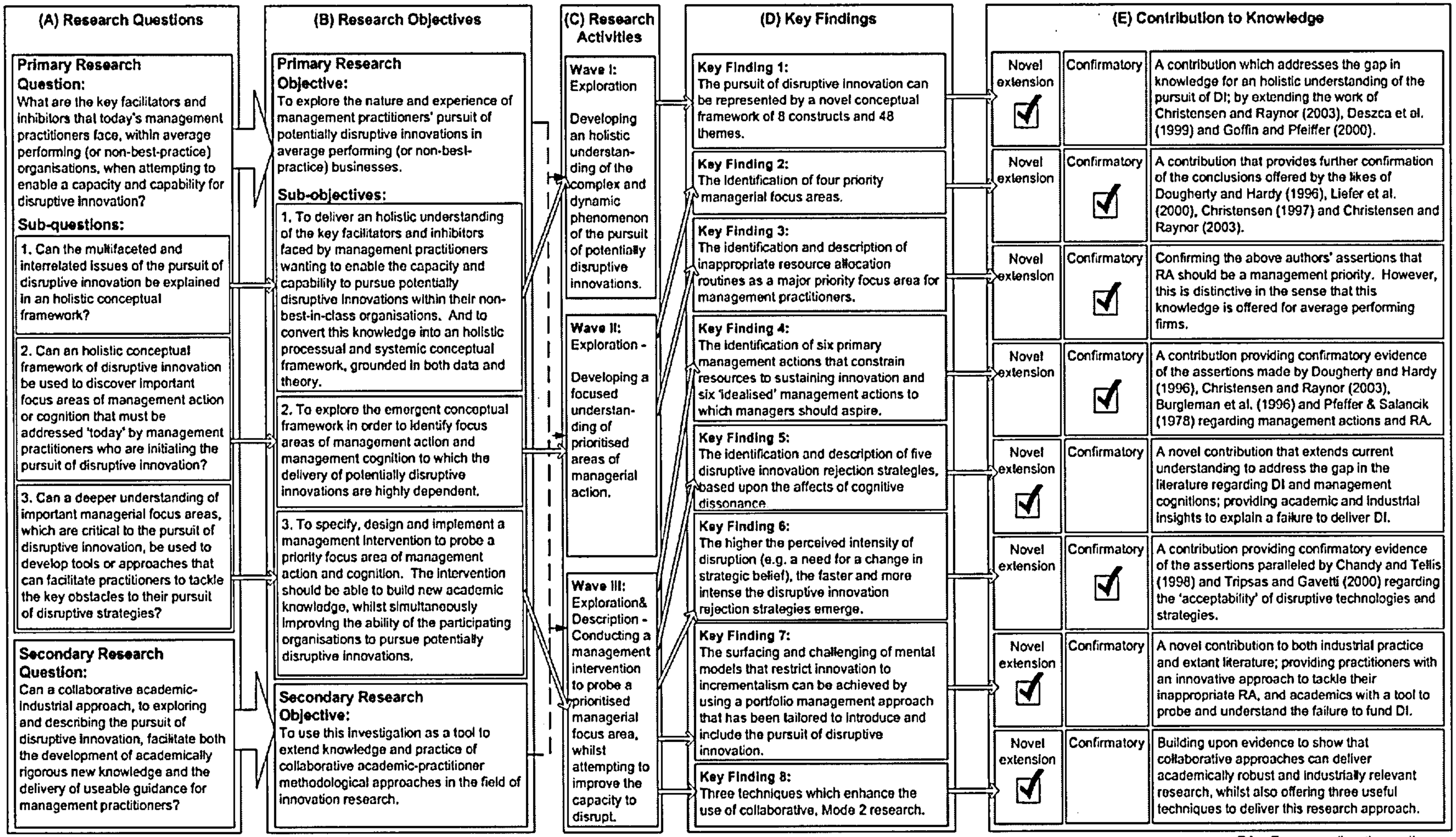


Figure 8-1: An illustration to map the progression from research questions to findings that contribute new knowledge in the form of new corroborations or original extensions of existing understanding.

To conclude this thesis, this chapter will provide a summary of the preceding diagram. A summary of the research approach is offered and the findings of each wave of the research are addressed in turn, illustrating how the research objectives were met. During this process, the evidence is assessed, illustrating that this thesis offers both new, confirmatory support for existing knowledge and novel extensions of existing theory that address gaps in prevailing understanding. In doing so, this chapter asserts a lucid and realistic contribution to knowledge. To close the thesis, this chapter offers recommendations for future research and a final comment from the author.

8.2 Research approach

The literature review enabled the formation of a definition of disruptive innovation along with the identification of a primary research question. The research question led to the development of the primary research objective for this investigation:

To explore the nature and experience of management practitioners' pursuit of potentially disruptive innovations in average performing (or non-best-practice) businesses.

In an attempt to satisfy this research objective, a review was made of the methodologies used in the extant literature. It was found that past research was mostly quantitative, with a positivistic perspective and had followed two main approaches:

- building historical accounts, in retrospect, of either disruptive innovations or failed attempts to disrupt, or
- conducting longitudinal investigations following the progression of an organisation's attempts to exploit a potentially disruptive technology.

It is the opinion of the author that these dominant research approaches have done much to illustrate and describe the prevalence, importance and process of disruptive innovation. However, their appears to exist somewhat of a disconnect from the management actions and cognitions to which the phenomenon is dependent – it is in these areas where there is a lack of an holistic understanding. New and Payne (1995:75) state that "It is possible to have academic research which scores high on rigour and cleverness but low on connection to real problems..." and they claim that in management, more than any other discipline, there is a fundamental need to make a "... commitment to an encounter with that which management and workers do..." (p75). This

opinion combined with the growth of action research (Reason and Bradbury, 2001; Coughlan and Coghlan, 2002) and the growing demand for management research that is both rigorous and relevant (Tranfield, 2002) led to the adoption of a collaborative, Mode 2 research design, that was both exploratory and qualitative in nature.

The use of a qualitative research design and data collection analysis inspired by *grounded* (Strauss and Corbin, 1990), collaborative approaches, is a highly unusual method to investigate disruptive innovation. It is believed that the ability of the researcher to digress from more traditional approaches is both reflective of the prevailing gaps in knowledge and current debates within the academic community regarding the concept of rigour and relevance within management and organisational research. For this reason a secondary research question was generated, which led to the development of a secondary research objective:

To use this investigation as a tool to extend knowledge and practice of collaborative academic-practitioner methodological approaches in the field of innovation research.

It would seem that innovation researchers, in particular those within the context of a PhD, are required at some point in their studies to make a choice between breadth and depth of study - as straddling the two presents significant challenges (Adams, 2004). This research was no different, it consisted of three empirical waves implemented in series to provide increasing focus to the research. The next section will highlight the research objective and the research method employed for each wave of the investigation, it will then outline the key findings in terms of their novelty and contribution to knowledge.

8.3 Contribution to knowledge

The primary objective of the thesis was to *explore the nature and experience of management practitioners' pursuit of potentially disruptive innovations in average performing (or non-best-practice) businesses.* As shown in Chapter 3 (the research methodology) this investigation was broken down into three waves, each of which had its own sub-objective. The findings from each wave of the research contribute, with varying degrees of novelty, to the existing body of academic theory, and combined, they contribute in two further areas: the methodology of innovation research, and the theory of practice.

The qualitative nature of the research means that the findings of this investigation cannot be assessed by traditional, statistical measures of reliability, nor can the outcomes be viewed as facts or objective truths, as they are the result of an interaction between the researcher and the researched (Silverman, 2000). Thus, the value of the findings, in terms of their generality and validity, results from their degree of credibility to those with an interest in the research area (Greenwood and Levin, 1998; Susman and Evered, 1978; Wyatt, 2001). The findings presented in this thesis are grounded in a real world investigation and have been evaluated by the industrialists involved in the research as having a high degree of relevance. It is therefore believed that this research has generated new knowledge that can contribute to an enhanced understanding for future theory development. These contributions are summarised in the remainder of this section.

8.3.1 Contributions to knowledge made by the first wave of this research

The first wave of this research was broad. Its aim was to introduce the concept of disruptive innovation to four non-best-in-class case organisations and to conduct a qualitative, collaborative, exploratory investigation into how managers adopt this new knowledge and begin their pursuit of disruptive innovation. Sub-objective 1 was:

> **To deliver an holistic understanding of the key facilitators and inhibitors faced by management practitioners wanting to enable the capacity and capability to pursue potentially disruptive innovations within their non-best-in-class organisations. And to convert this knowledge into an holistic processual and systemic conceptual framework, grounded in both data and theory.**

In attempting to satisfy this sub-objective the author wanted to garner an holistic understanding of the complex web of conventions, rules, actions, behaviours and cognitions that contribute to enabling or inhibiting the pursuit of potentially disruptive innovations in today's organisations. This was completed by triangulating the observations within the four case organisations with data from expert interviews and state of the art literature.

The final outcome of this first wave of research was the first key finding of this investigation: the pursuit of disruptive innovations can be represented by a novel conceptual framework of 8 constructs and 48 themes (Figure 8-2).

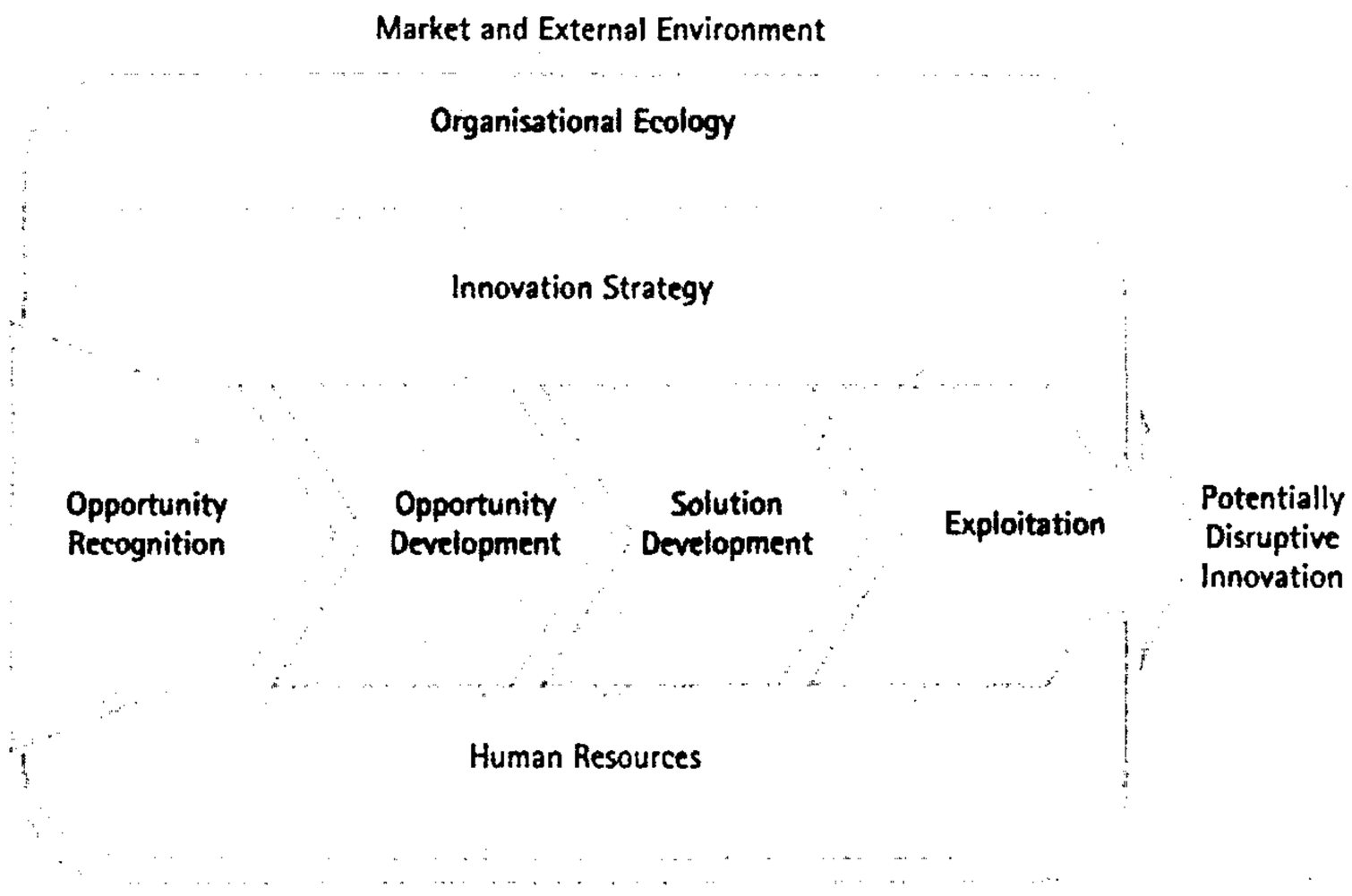


Figure 8-2: A conceptual framework of the pursuit of potentially disruptive innovation (see Chapter 4 for a more detailed illustration).

Chapter 4 describes this conceptual framework, how it is both processual and systemic in nature and is grounded in real world data as well as extant literature, and, therefore, appears to satisfy the aforementioned research objective. It is also believed that the conceptual framework addresses the prevailing gap in knowledge which can be represented as a need for an holistic understanding of the issues faced by management practitioners wishing to pursue disruptive innovation. It does this by combining, in one model, many of the facets of disruptive innovation that have been described in isolation and in doing so it offers a novel extension of existing models and theory. It is similar in fashion to the model for developing breakthrough products offered by Deszca et al (1999), however, it extends their ideas beyond the focus of market assessment; it also offers more information and advice as it focuses upon both enablers and inhibitors within each dimension of the framework. Moreover, it has taken influence from the Pentathlon Model published by Goffin and Pfieffer (2000), yet is more focused and detailed than their description of the general pursuit of innovation. The emergent conceptual framework also both dissects and expands upon Christensen and Raynor's (2003) approach to describing disruptive innovation in which they discuss disruption in terms of technological trajectories, marketing processes, resources and values. Furthermore, the conceptual framework has been shown to have industrial utility. It was used to facilitate the management practitioners involved in this research to uncover what they perceived to be critical managerial focus areas. And Michel, Monville and Thomond (2004) show how it was used to assess the

capacity and capability to pursue disruptive innovation within a small-medium sized French manufacturing organisation. Thus, it offers both academics and practitioners alike, an holistic, graphical understanding that was missing at the onset of this research.

By combining, in one model, many of the facets of disruptive innovation that have been described in isolation, the conceptual framework developed in the first wave of this investigation contributes a novel extension to existing models and theory. This will aid both academics and practitioners to better understand the complexity of the pursuit of disruptive innovation.

8.3.2 Contributions to knowledge made by the second wave of this research

The second wave of this research was less broad and deeper in nature. The aim was to use the conceptual framework, which emerged in the first wave of this research, as a tool to help identify important managerial focus areas. Sub-objective 2 was:

To explore the emergent conceptual framework in order to identify focus areas of management action and management cognition to which the delivery of potentially disruptive innovations are highly dependent.

In attempting to satisfy this sub-objective, a collaborative and qualitative approach was utilised with constant feedback between the literature and practice. Four focus areas emerged as the second key finding of this research:

1. Inappropriate resource allocation routines.
2. A failure to address the strategic importance of disruptive innovation.
3. An inability to identify or to generate disruptive foothold markets.
4. Traditional new product/service development routines

These focus areas have also been identified as highly important factors by Dougherty and Hardy (1996), Liefer et al. (2000), Christensen (1997) and Christensen and Raynor (2003). Therefore, this second key finding cannot be asserted a novel contribution to knowledge. However, it does provide new confirmatory evidence to support the conclusions offered by the aforementioned authors. This is in itself a useful academic contribution that should not be overlooked. Moreover, the descriptions of the focus areas, offered as an output of this investigation in Chapter 6, provide useful insights and a more qualitative perspective than is often offered by the extant literature.

The second wave of this research has contributed new confirmatory evidence to support the prevailing knowledge base with the identification of four managerial focus areas.

This second wave of the research also generated the third key finding: the identification and description of inappropriate resource allocation routines as a major priority focus area for management practitioners. Once again the description that was enabled by the qualitative investigation allowed the author to confirm past descriptions of the structural and situational context of resource allocation (Bower, 1970; Burgleman, 1983; Leonard-Barton, 1992; Ansoff, 1965; Burgleman et al., 1996). However, it also facilitated a deeper understanding of the softer issues such as the importance of mental models and the resultant psychological inertia that can occur within resource allocation decision-making. Moreover, the analysis of the findings enabled the identification of circumstances and/or management actions that could be proposed as highly important in attempts to overcome the resource allocation barrier (see Chapter 5 table 5-6). This insight formed the beginnings of a novel contribution that was explored further in the third wave of the research. It is believed that this finding responds to Bessant's and Francis' (2004) implied appeal for the identification of "alternative routines for discontinuous innovation ('do different' routines) which can sit alongside those for steady state 'do better' innovation" (p135).

The second wave of this research has contributed new evidence to confirm the importance of resource allocation routines. In doing so it also highlights the important qualitative nature that is mostly overlooked by the prevailing knowledge base and begins to identify resource allocation approaches that managers can 'do differently'.

8.3.3 Contributions to knowledge made by the third wave of this research

The final wave of this research was an in-depth analysis of the critical managerial area of inappropriate resource allocation routines. Sub-objective 3 was:

To specify, design and implement a management intervention to probe a priority focus area of management action and cognition. The intervention should be able to build new academic knowledge, whilst simultaneously improving the ability of the participating organisations to pursue potentially disruptive innovations.

The final wave of this research drew upon the experience, relationships and knowledge built in the first two waves. A collaborative and qualitative approach was utilised with constant feedback

between the literature and practice, this enabled the design and implementation of a management intervention to probe the inappropriate resource allocation routines of cases A and B.

The analysis of the data gathered during the design and implementation of the intervention enabled the fourth key finding: the identification of six primary management actions that constrain resources to sustaining innovation. And by cross-referencing this finding with the data from expert interviews and the literature, six 'idealised' management actions, to which managers should aspire, were also generated. Chapter 7 shows that these findings reiterate much of what has already been reported in the literature, therefore suggesting a lack of novelty; however, they make a useful academic contribution as they provide new confirmatory evidence to support the assertions made by Dougherty and Hardy (1996), Christensen and Raynor (2003), Burgleman et al. (1996) and Pfeffer & Salancik (1978) regarding management actions and (in)appropriate resource allocation.

The third wave of this research identified six primary management actions that constrain resources to sustaining innovation and six 'idealised' management actions to which managers should aspire. This provides confirmatory support for extant literature and useful insights for management practitioners.

With respect to this finding, it was shown in the preceding chapter that novelty, in terms of a contribution to knowledge that extends current thinking, could only be achieved if the deeper causes of these constraining actions could be identified. In cross examination of the data underpinning these constraining management actions the author uncovered five 'disruptive innovation rejection strategies':

1. Rewarding incrementalism.
2. Ignoring the positive aspects of disruptive opportunities and/or removing the negative aspects of sustaining innovation.
3. Focusing upon historical perceptions of success
4. Creating perception of success with high effort
5. Holding beliefs in the face of disconfirming information

The strategies were found to be common across all four case study organisations and could be considered as the prime reasons for their failure and inability to pursue potentially disruptive ideas and/or innovation projects. It is believed that the emergence of the disruptive innovation rejection strategies from the data is, in itself, a contribution to further understanding.

Moreover, the data locates the support for the rejection strategies in the often difficult to perceive cognitive routines of the management practitioners. And when considering this data through the lens of cognitive dissonance or organisational learning an even richer picture can be presented and several propositions for management practitioners can be established (see Chapter 7). Therefore, it is the assertion of the author that this finding has contributed to a deeper understanding of the resource allocation routines that undermine the pursuit of disruptive innovation; specifically with respect to the breakdown between the stated and actual support of potentially disruptive innovations. Furthermore, the uncovering of the rejection strategies and the contention of their link to cognitive dissonance, mental models and organisational learning, makes steps towards answering the call for a better understanding of the impact of managerial cognitions upon the pursuit and delivery of innovations of a disruptive nature (Tripsas and Gavetti, 2000; Kaplan et al., 2003).

The third wave of this research identified that management practitioners suffer with cognitive dissonance when presented with potentially disruptive innovation options that conflict with prevailing mental models. This leads them to employ one or a combination of more than one of five disruptive innovation rejection strategies; the use of these strategies allows the practitioners to justify, in their minds and to their organisation, the rejection of disruptive opportunities in favour of sustaining/incremental alternatives. In extending the understanding of constraining management actions, this offers a novel contribution that addresses a gap in the literature regarding disruptive innovation and management cognitions. This new knowledge provides a series of both academic and practical insights to explain why many organisations fail to deliver disruptive innovation.

Another key finding of the third wave of this research was: the higher the perceived intensity of disruption (e.g. a need for a change of ingrained strategic belief is perceived as more intense than an acceptable market repositioning), the more significant the experience of cognitive dissonance and the faster and more intense the disruptive innovation rejection strategies would emerge. Once again, this finding was developed from an in-depth context specific understanding, yet it also emerged in discussion, without prompting, in over half of expert interviews, and this observation has been paralleled by reports of management action in the literature (e.g. Chandy and Tellis' (1998) descriptions of a reluctance to self-cannibalise, and Tripsas and Gavetti's (2000) accounts of Polaroid's failure to adopt a successful model for the disruptive digital imaging business, despite a technological advantage).

The third wave of this research offers confirmatory evidence for the likes of Chandy and Tellis (1998) and Tripsas and Gavetti (2000) who content that the speed at which an innovation opportunity - that this research would consider to be disruptive - is pursued or rejected will depend upon its congruence with the perspectives of top management.

The seventh key finding of this research contributes to the theory of practice. It was found that it is possible to surface and challenge mental models that restrict innovation to the pursuit of incrementalism, by using a portfolio management approach that has been adjusted and tailored to introduce and include the importance of disruptive innovation. The development and successful implementation of the 'Disruptive Portfolio Management' intervention in the final wave of this research led to this finding. The author has found no other references to the extension and use of portfolio management tools in this manner, and despite a significant investigation into existing innovation facilitating tools, there appears to be no well documented equivalent process on the market place. For this reason, it is contended that this finding can be asserted as a novel and lucid contribution to both extant literature and industrial practice; providing academics with a tool to probe and understand the failure to fund disruptive innovation, and industrialists with a novel approach to tackle their inappropriate resource allocation routines.

The third wave of this research offers a novel contribution in the finding that it is possible to surface and challenge mental models that restrict innovation to the pursuit of incrementalism, by using a portfolio management approach that has been adjusted and tailored to introduce and include the importance of disruptive innovation. This new knowledge addresses a gap in the literature and in practice regarding the challenging of prevailing resource allocation routines, in order to facilitate the pursuit of potentially disruptive innovations.

8.3.4 Contributions to knowledge made by the research approach

As previously explained, this research employed a collaborative, Mode 2 (Tranfield 2002) research design. In the field of disruptive innovation this research design was novel. Therefore, it was decided that this investigation would also be used as a tool to extend knowledge and practice of collaborative academic-practitioner methodological approaches in the field of innovation research.

It is believed that the instruments and protocols developed throughout this investigation offered the author an opportunity to simultaneously seek relevance without sacrificing rigour. For example, contributions to knowledge have been made (e.g. an holistic conceptual framework of disruptive innovation and the identification five common disruptive innovation rejection strategies), whilst simultaneously enabling the participating case organisations to enhance their capacity and capability to foster *and* deliver potentially disruptive innovations (e.g. Chapter 7, Table 7-2, illustrates Case A's and B's confirmation that they had improved their ability to allocate resources to potentially disruptive innovations).

Consequent reflection upon the experience of using this methodological approach garnered an assessment of the pros and cons the research design and led to the identification of the final key finding of this investigation. This finding can also be offered as a contribution to knowledge and as recommendations for the improved practice of Mode 2 collaborative research programmes in the future:

The collaborative academic-industrial approach can be further facilitated by the exploitation of three features, which are additional to those presented in the extant literature.

i) The active pursuit of an open and trusting work environment by all involved parties.

ii) The co-creation of a conceptual framework to describe the research area of interest, in order to develop a shared language and to enable the emergence of a shared research agenda with two-way connections between academia and industry.

iii) The use of large-scale graphical facilitation approaches to record and disseminate data, and to elicit public commitment to research actions.

8.4 Recommendations for future research

This section provides recommendations for future research. It will not offer an exhaustive list of possible research avenues or extensions to the current investigation. Instead, the author has imagined that he has been asked to propose three new PhD research programmes. Each of the following programme proposal overviews aims to tackle or further probe remaining gaps in knowledge with respect to disruptive innovation or the wider innovation agenda.

Research Programme 1: Linking disruptive innovation theory to the renewable energy market.

AIM: To investigate whether renewable energies could benefit from consciously positioning themselves as a disruptive innovation.

BACKGROUND AND ANTICIPATED CONTRIBUTION:

The depletion of the world's resources has resulted in a growth of organisations focused on the pursuit of offering renewable energies. Yet the proposition of using or benefiting from these energy sources, for much of the public, is either not practical or incomprehensible. Moreover, those seeking to promote alternative 'green' energy are left marginalised by the powerful energy incumbents. This research programme would attempt to investigate whether or not the integration of the theory 'disruptive innovation' into the strategies (and senior management mind-set) of renewable energy providers would affect competitive advantage

and share of energy markets? It is hoped that this research could be used as a contribution to both academic understanding and industry. Academia would benefit from rich data concerning the issues of understanding, adopting and implementing a disruptive strategy. And Governmental policy makers (as well as the organisations involved) could gain valuable insights into attempts at increasing public access to green energies.

RESOURCES REQUIRED:

1 x PhD student.

1 x cluster of non-competitive renewable energy organisations, linked to a Governmental 'green energies commission'.

METHODOLOGY OVERVIEW:

1) Build cluster of non-competitive renewable energy organisations with link to a Governmental 'green energies commission'.
2) Work with the senior management teams of each renewable energy case to understand current competitive position.
3) Co-ordinate and implement case specific training and awareness raising workshops regarding disruptive innovation.
4) Co-ordinate and implement cross case workshops to encourage cross fertilisation of ideas.
5) Monitor and record all progress toward the goals of market share development.
6) Repeat steps 4 and 5 with the involvement of Government policy makers and publish.

Research Programme 2: Holistic thinking tools and the pursuit of disruptive innovation

AIM: To empirically test the impact of holistic thinking tools in the context of facilitating the pursuit of disruptive innovation.

BACKGROUND AND ANTICIPATED CONTRIBUTION:

There exists prevailing gaps in knowledge regarding how or why holistic thinking tools seem to help the facilitation of organisational change (Young, 2003). Yet authors such as Cooper et al. (2001) and Phaal et al. (2004) use holistic portfolio management tools and technology roadmapping respectively, to facilitate improved management and more efficient resource

allocation in the new product development and technology management process. It is hoped that a comparative analysis of holistic thinking tools, within the specific context of trying to facilitate the pursuit of disruptive innovation, would begin to address this gap in knowledge. Moreover, it would compliment the findings of this thesis by bringing more grounded understanding to the issues faced by organisations attempting to pursue disruptive strategies.

RESOURCES REQUIRED:

1 x PhD student with experience of initiating or delivering organisational change programmes, who would be willing to learn how to use and adapt tools such as Learning Maps, Visual Metaphor Elicitation (Young, 2003), Technology Roadmapping (Phaal et al., 2004) and Portfolio Management.

METHODOLOGY OVERVIEW:

1) Find case study for involvement in action research: 1 x manufacturing organisation with a large and diverse product portfolio.

2) Select 5 holistic thinking tools and working with senior members of the case study organisation (in order to take account of cultural issues) and state of the art literature, adapt them with the aim of facilitating the pursuit of disruptive innovation.

3) Create 5 "innovation teams" within the case study site, of roughly equal size and ability.

4) Implement a different tool within each innovation team. Recording each group member's knowledge, thoughts, behaviour and comments, regarding disruptive innovation and the pursuit of disruption, prior to, during and after the interventions.

5) Codify the resultant data of each group individually, using state of the art qualitative data analysis techniques.

6) Build cross group themes of the factors that emerge as important to the benefits and drawbacks derived by holistic thinking.

RESOURCES REQUIRED:

1 x PhD student with experience of initiating or delivering organisational change programmes, who would be willing to learn how to use and adapt tools such as Learning Maps, Visual Metaphor Elicitation (Young, 2003), Technology Roadmapping (Phaal et al., 2004) and Portfolio Management.

Research Programme 3: A change management programme that attempts to introduce and deliver benefits from the pursuit of disruptive innovation.

AIM: To conduct a three year action research case study in complete context immersion, which follows an organisation's change management programme that attempts to introduce and deliver benefits from the pursuit of disruptive innovation.

BACKGROUND AND ANTICIPATED CONTRIBUTION:

This programme of research was inspired by the author's frustrations with the investigation that he undertook. It would make constant deeply involved access a prerequisite. Research with the above aim could document, in real time, vast amounts of context specific, rich, qualitative data, in a more exhaustive and less task focused manner (i.e. beyond a focus on senior management resource allocation). It would contribute an understanding of how the topic of disruptive innovation is viewed and understood by people from different divisions and at all levels of the business. And what impact the introduction of the topic has upon the systems and culture of the business. Although such research would not contribute generalisable theory, it would shed light on new areas of interest and focus.

RESOURCES REQUIRED:

1 x PhD student permanently based within a large R&D based organisation that wants to reinvigorate its innovation effort with a focus on both sustaining and disruptive innovation.

The PhD student must have operational experience of change management.

METHODOLOGY OVERVIEW:

1) Find case study for involvement in action research: 1 x manufacturing or service organisation with a large and diverse product portfolio that has fallen into a "more of the same" trap.

2) Working with the senior management team, conceive of and initiate a change management programme focused on delivering more benefits from innovation (including a focus on disruptive innovation).

3) Monitor and record the actions taken by the change management team and monitor and record the impact and response within the business; providing a consulting and feedback

role, but no direct operational responsibility that would detract from the data collection and analysis objective.

4) Present two case study reports: one as a story and the second codified by the conceptual framework developed by this thesis.

8.5 A final comment

It is the author's view that the ever increasing rates of technological change will continue to push the subject of disruptive innovation to the fore of academic and industrial attention. Moreover, the ever growing influence of the Chinese and Asian economies will make disruptive innovations more pertinent for increasingly vulnerable, average performing British and European organisations. Hence, the organisations involved in this study were not world leading innovators, but they were organisations led by industrialists who understand that innovation could bring new sources of competitive advantage. The extant literature and this investigation provides evidence to show that the delivery of disruptive innovation is not based upon luck; instead, it was found that it is important to identify and target appropriate niches of customers who are, in effect, the gateway to a path of disruption. Whilst much of the prevailing literature concentrates upon finding the gateway or describing the nature of this path (in terms of technological trajectories, marketing approaches, project teams, leadership styles etc.), there appears to be little understanding of the factors that enable or inhibit managers in average businesses to allocate and protect the necessary resources to target and open the gateway in the first place. It is hoped that this research has contributed understanding to explain the difficulties faced in embracing the notion of disruption and that this understanding will inspire more academic research into these important qualitative factors. Moreover, it is hoped that the avenue of research initiated by this thesis, and the findings presented within, will one day empower managers to reject tradition and authority as infallible sources of 'truth', facilitating them to embrace free innovative inquiry, and the desire to be proactively disruptive.

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10. Appendices

This chapter presents a series of appendices offering further information for the reader

Appendix 1: Supporting notes for the literature review

Appendix 1a: Examples of disruptive innovation

Example A: LED Candles to light-bulbs and light-bulbs to LEDs?

Future predictions of disruption include the potentially disruptive impact that Light Emitting Diode (L.E.D.) technology could have on the traditional light bulb sector (figure A1). Single LEDs are not as effective as standard light-bulbs, however, clustered and improved, the author has observed that they are already being used in place of three single light-bulbs in many traffic light system across Spain – saving energy, lasting longer and much more durable in the face of the outdoor elements. Furthermore, the author recently purchased a simple hand held torch utilising LED technology, although marginally more expensive than and not as effective as a traditional device it offers other advantages - it is more durable, it is only the size of a credit card and has a life time guarantee. The days of the traditional light-bulb may be numbered – perhaps this is why Philips recently purchased the organisation with the patents to the LED technology that produces white light?).

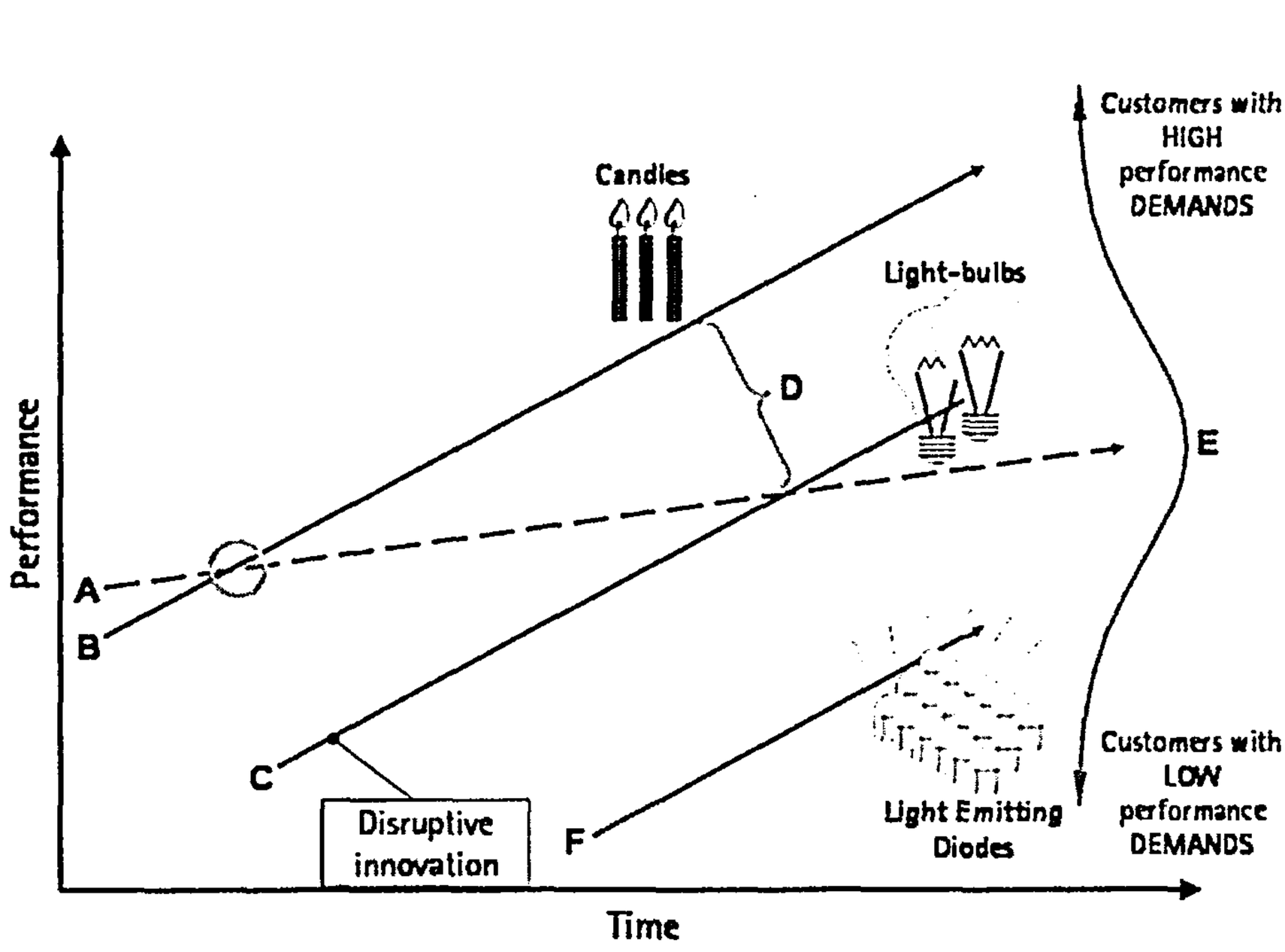


Figure A1: The disruptor could be disrupted: light-bulbs Vs LEDs

Example B: Open heart surgery Vs Angioplasty

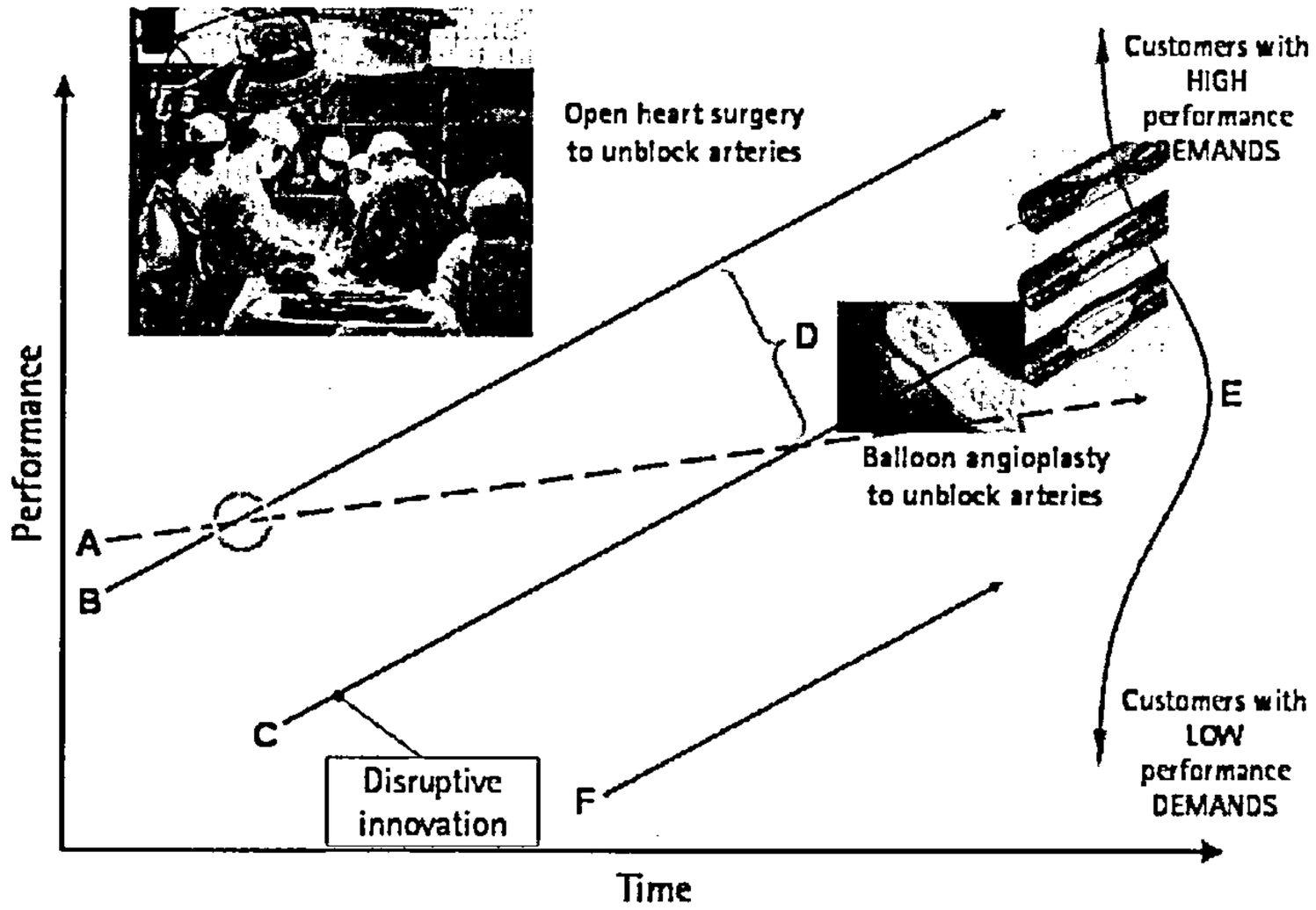


Figure A1: Using disruptive innovation to improve access to health provision - Open heart surgery Vs Angioplasty

Access to life saving procedures has been increased with the aid of disruptive innovation. For example, hospitals around the world needed highly expert people in specialised environments to conduct operations on patients in desperate need to have their arteries unlocked. Few people were eligible to the specialised services of the heart surgeons, however, the invention and commercialisation of the balloon angioplasty process has disrupted this paradigm of patient care by making the heart surgeon over qualified for the needs of the patients. (figure A2) Multitudes more people now have access to and receive the life saving procedures that were once offered by specialists which are now offered by less skilled people in a more convenient setting. The initial pessimism of the heart surgeon traditionalists and the patients' negative perception that less skilled people were being used for their critical procedures was eventually overcome by the benefits offered by the new trajectory of performance obtainable through angioplasty. The theory of disruptive innovation can be applied more broadly to health provision; for example, currently within the British National Health Service there is controversial debate about transferring a

number of patient care activities from doctors to nurses and pharmacists. This has been met by objections from the traditionalists but is clearly an example of how patients can be given increased access to basic and pre-emptive care and treatment without the need of highly qualified doctors who are mostly overqualified for such treatment.

Example C: The Computing Industry

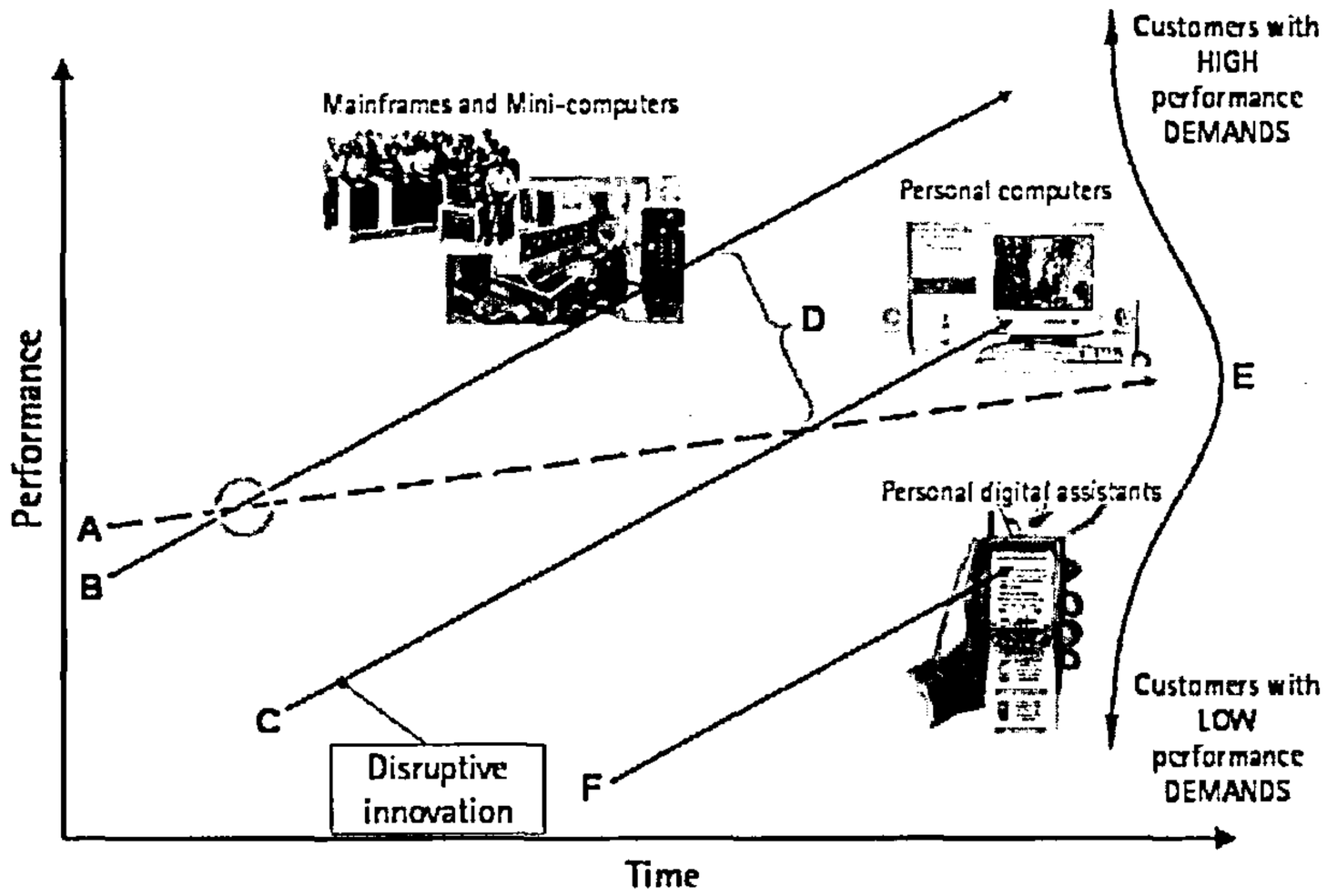


Figure A3:Disruptive innovations have liberalised computing technology

Only four decades ago access to computer technology was the reserve of prestigious organisations (Foster and Kaplan 2001); gradually technology such as mainframe computing infiltrated more workers lives but still access to computing was not close to the level to which we see it today. Christensen (1997) shows how the pace of technological progress generated by traditional mainframe and mini-computer manufactures inevitably outstripped customers abilities to absorb it, and that this created an opportunity for a new offerings to displace the incumbents. With hindsight it is clear that the invention of a small disk drive that would operate a computer that could fit onto a desk was the major step to liberating the benefits of computing technology to the masses (figure A3). This technology was first invented by the computer industry giants 'IBM' but was ignored (Foster and Kaplan 2001) as it did not satisfy the performance trajectory of the high-end computer customers (Christensen, 1997) or their historic path dependence (Tidd, Bessant, and Pavitt, 1997). Since then Microsoft and Intel have captured the lions share of the computer industries profits (Christensen, Raynor and Verlinden, 2001) and the world of computing has changed forever. Still it is the premise of the author that the 'personal computer (PC)' in its

traditional form (the desk-top or the laptop) over-supplies the needs of many users around the world. A key indicator of this fact is that incremental sustaining improvements are valued less and less by the market. Could the benefits of easy immediate access to personal digital computing disrupt the traditional PC market? Are the computer manufacturers ready for such a disruption? Who will be the winners?

Example D: The Music Industry

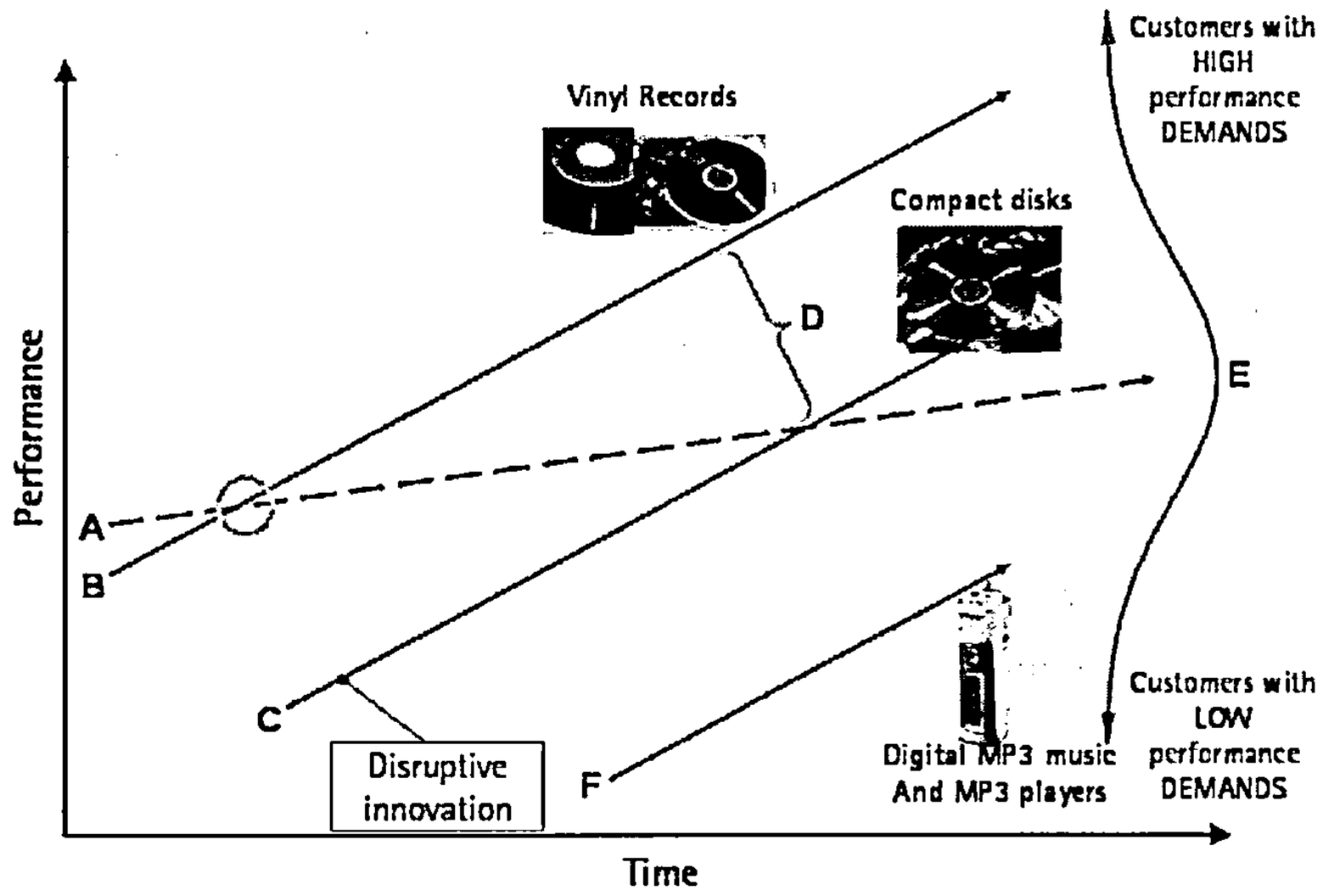


Figure A4: Disruption changing the shape of music

Compact disk (CD) technology revolutionised the music industry and caused major disruptions in the manufacturing of recorded music. Customers' lives changed to accommodate the new CD technology as increasingly more people found that it offered them a new value proposition that nullified the traditional vinyl records offering - almost eradicating the need for this form of music device. However, the music industry now faces an even larger disruption in the form of digital or 'mp3' music (figure A4). The mp3 format, although lower in quality than the compact disk, offers customers a wide range of benefits that have not been fully considered by the music industry or traditional CD sales outlets. The value proposition offered by mp3s gave birth to the emergence websites such as "napster.com" which allowed its 'customers' to share mp3 files, eradicating the need for the CD format, the CD distribution channels and even more worryingly for the music industry, customers could now 'share' and not purchase music. Legal issues forced the closure of

napster, but the music industry has not been able to prevent that onslaught of disruption. The key record labels have to accept that they will no longer be able to maintain the revenue levels to which they have become accustomed. It can be argued that access to music as a life improving product has been increased and the new format has created a basis on which long term organisational survival could be ensured for the likes of Apple who have embraced the inevitable disruption and transformed the music player industry with their I-Pod offering.

Appendix 1b: The 18 features of the term disruptive innovation

In order to generate an understanding of the features of the term disruptive innovation, the publications on the topic were reviewed along with literature from the broader fields of discontinuous and radical innovation. By using the definitions of disruptive innovation and potentially disruptive innovation, developed above, focus could be kept whilst considering the wider context; a critical appraisal generated the 18 themes or key features of the term disruptive innovation (see Appendix 1b Table B-1), below are the five most frequently mentioned:

Table A-1: Recurrent themes in the literature with respect to the definition of disruptive innovation and competence destroying discontinuities

Theme (DI = disruptive innovation)	Examples of Authors
(1) Impact of DI is transformational and broad- e.g. effects multiple perspectives and multiple units of analysis	Leiffer et al. 2000, Christensen (1997) Tushman and Anderson (1986) Tidd, Pavitt and Bessant (1997), Kassiecieh et al (2002)
(2) Trajectories: DIs create a significant shift in 'performance trajectories' whereby they initially offer lower performance as perceived by the existing markets incumbents	- e.g. Christensen (1997), Christensen, Raynor and Verlinden (2001), Bower and Christensen (1995), Raffi and Kampas (2002), Shumpeter (1975), McKee (1992)
(3) DI offers less functionality as perceived by customers and suppliers within the mainstream	- e.g. Christensen (1997), Christensen, Raynor and Verlinden (2001), Bower and Christensen (1995), Raffi and Kampas (2002), Moore (1995), Charitou and Markides (2003)
(4) DI offerings target real existing customer needs, in particular offering superior performance to those exogenous to mainstream existing markets	- e.g. Christensen (1997), Christensen, Raynor and Verlinden (2001), Bower and Christensen (1995), Raffi and Kampas (2002), Moore (1995), Charitou and Markides (2003), Kassiecieh et al (2002), Walsh & Kirchhoff (2002), Linton and Walsh (2001)
(5) DIs are first established in non-	- e.g. Christensen (1997), Christensen, Raynor and

demanding customer niches - where the organisation can be patient for growth but impatient for profitability	Verlinden (2001), Bower and Christensen (1995), Raffi and Kampas (2002), Moore (1995), Charitou and Markides (2003), Kassiecieh et al (2002), Walsh & Kirchhoff (2002), Linton and Walsh (2001)
(6) DIs displace incumbents from existing industries - usually by improving from 'below them'	- e.g. Christensen (1997), Christensen, Raynor and Verlinden (2001), Bower and Christensen (1995), Raffi and Kampas (2002), Moore (1995), Charitou and Markides (2003), Kassiecieh et al (2002), Walsh & Kirchhoff (2002), Linton and Walsh (2001)
(7) DIs require a significant change in customer behaviour	- e.g. Walsh & Kirchhoff (2002), Moore (1995), DeTienne and Koberg (2002), Tushman and Anderson (1986), Martinich (2002), Zairi (1995)
(8) Over-performance or over-supply from traditional/existing offerings creates a space for disruptive innovation	- e.g. Christensen (1997), Christensen, Raynor and Verlinden (2001), Bower and Christensen (1995), Raffi and Kampas (2002), Moore (1995), Charitou and Markides (2003)
(9) DIs are not radically new to the world from a technology perspective	- e.g. Walsh and Kirchhoff (2002) Christensen, Raynor and Verlinden (2001), Bower and Christensen (1995), Moore (1995), Mascitelli (2000)
(10) DIs create 'new competitive paradigms' with new technology-product paradigms	- e.g. Abernathy (1978), O'Connor and Veryzer (2001), Tushman and Anderson (1986), Kassiecieh et al (2002), Rice, Leifer and O'Connor (2000), DeTienne & Koberg (2002), Christensen (1997), Dowd and Walsh (1998)
(11) DIs are mainly the domain of start-ups, but can be exploited by all organisations	- e.g. Tushman and Anderson (1986), Kassiecieh et al (2002), Christensen (1997), Christensen and Raynor (2003)
(12) DIs re-write competitive rules - introducing new firm and market based competencies, with introduction of new produce/service attribute sets	- e.g. Kassiecieh et al (2002), Tushman and Anderson (1986), Abernathy and Clark (1985), Dowd and Walsh (1998), DeTienne & Koberg (2002)
(13) DIs provide future competitive advantage - they are the "wellsprings" of future sustaining innovation	- e.g. Kassiecieh et al (2002), Tushman and Anderson (1986), Dosi (1982), Schumpeter (1976), Rice, Leifer and O'Oconner (2000), DeTienne & Koberg (2002),
(14) DIs do not offer an order of magnitude improvement - discontinuities do so through significantly new-to-world technologies	- e.g. Christensen (1997), Kassiecieh et al (2002), Veryzer (1998), Mascitelli (2000):
(15) DIs are discontinuous but discontinuities are not necessarily disruptive	- e.g. Linton and Walsh (2001), Tushman and Anderson (1986), Linton and Walsh (2001), Christensen (1997 & 2002), Moore (1995)
(16) DIs are less risky than extreme discontinuities from a customer perspective - due to the strong customer focus	- e.g. Tushman and Anderson (1986), Linton and Walsh (2001), Christensen (1997 & 2002) McDermott & Handfield (1996)
(17) DIs are killed by traditional approaches to new product and service development and resource allocation practices.	- e.g. McDermott & Handfield (1996), Christensen (1997), Christensen, Raynor and Verlinden (2001), Bower and Christensen (1995), Raffi and Kampas

	(2002), Moore (1995), Charitou and Markides (2003), Kassiecieh et al (2002), Walsh & Kirchhoff (2002), Linton and Walsh (2001), Hamel (2000)
(18) DIs transform the relationships between customers and suppliers - enabling customers to do things that only specialists could do before in a more convenient setting	e.g.Rice, Leifer and O'Oconner (2000), Christensen (1997), Hamel (2000), Christensen, Raynor and Verlinden (2001), Bower and Christensen (1995), Raffi and Kampas (2002), Moore (1995), Charitou and Markides (2003)

Table A-1: Recurrent themes in the literature with respect to the definition of disruptive innovation and competence destroying discontinuities

Appendix 1c: Building an understanding of holistic approaches to innovation management.

A common representation of innovation is that of a temporal innovation process, where activities or events are built serially into categories, stages or phases. Such processes have been popularised by Cooper (1979, 1980, 1983, 1988, 1990), Cooper and Kleinschmidt (1987, 1990) and Cooper, et al. (1999, 2000, 2001). Although the number of stages varies across studies (Pelz (1983) identifies 8 and Cooper et al. (2001) 12) Figure 2-1 illustrates what has come to be known as a reasonably generic processual perspective of product innovation.

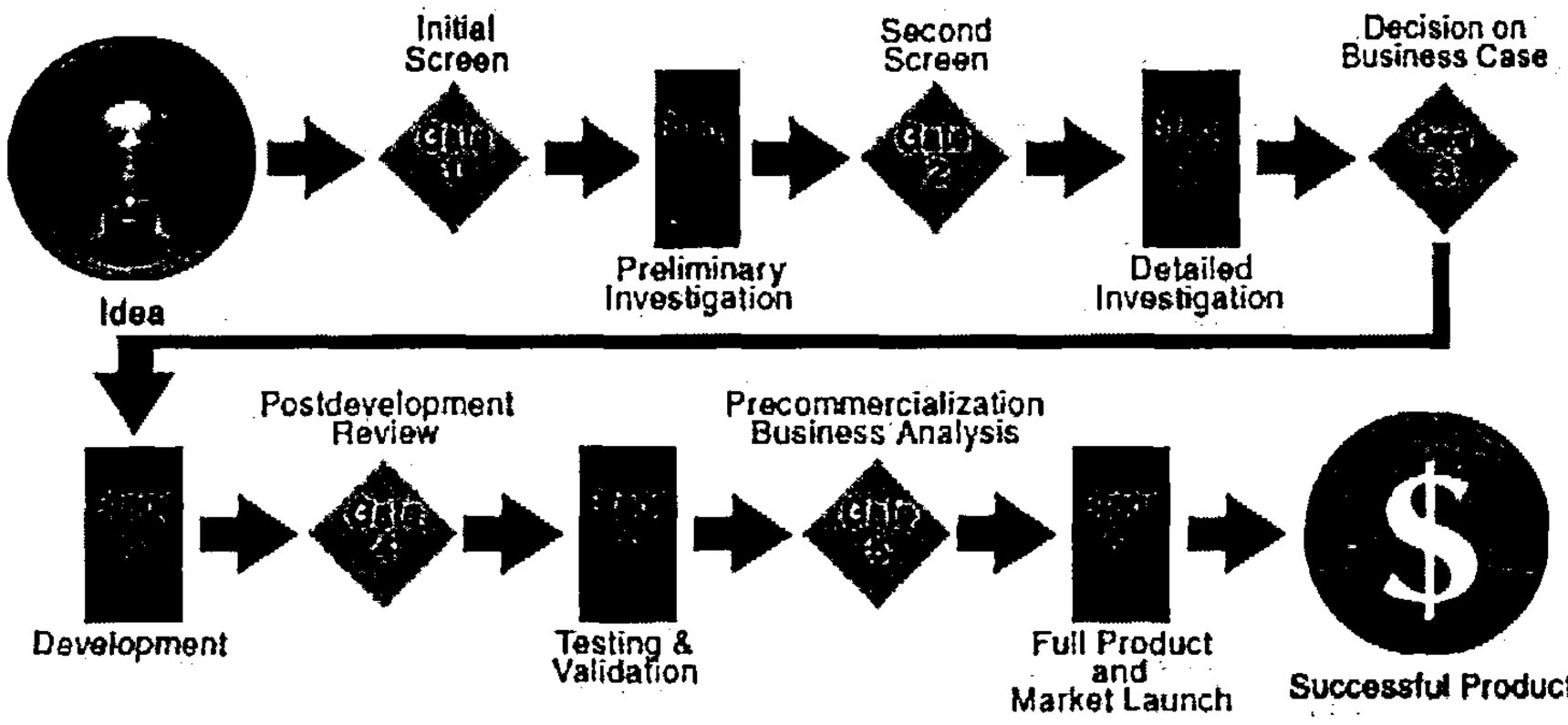


Figure 10-2: Stage Gate approach to new product development (adapted from Cooper et al., 2001)

While the processual perspective has proved popular over the last 25 years, in both innovation practice and academia (Cooper, 1979, 1980, 1983, 1988, 1990; Cooper and Kleinschmidt, 1987,

1990; Pelz, 1993), it is not without its critics. Van de Ven and Drazin (1985) proclaim that innovation should be considered in a systemic manner, where multiple contextual and structural characteristics have to be examined simultaneously to identify their effect upon performance. Adding to this, in a general criticism of prevailing conceptual frameworks of innovation, Mohr (1982) notes "There is a tendency to present the stages in the process but to omit the forces that drive from one stage to another. The latter, however, are essential" (p14). He adds "... process-orientated ideas in organisational behaviour, and in social science more broadly, tend to be primarily of the stage naming variety. They are incomplete from the standpoint of theory in that they simply rehearse a series of steps; they lack the lines of action – either causal or probabilistic – that must be present to convey a sense of explanation" (Mohr, 1982:53). Adams (2003) work adds weight to the criticism of the often over simplistically applied process models (Cooper, et al. 2000). His analysis of successful innovations in the UK National Health Service, plus extensive integration of the literature, resulted in the identification of a framework of activities and enabling conditions important to the innovation effort (Table 2-1).

Perspective	Category	Factor	
Activity	Triggers	Serendipity. Conjunctions. Problem recognition	Critical moments. Opportunism.
	Idea management	Information gathering. Selection, Integration/combination	Sifting. Proliferation
	Process formality	Degree of planning Sequence of events	Existing process
	Testing	Piloting	
	Implementation	Launch Foisted implementation	
	Managerial Commitment	Top management support Resource availability	
Enabling conditions	Group factors	Visions and guiding principles Champions and leadership Challenge the orthodoxy. Safety. Innovators tolerated/supported Making space Empowerment/autonomy Tolerance of uncertainty Mutual support Peer group credibility	Risk taking

Table 10-2: Factors important to innovation (Adams, 2003:207)

Consideration of Adams' (2003) framework reveals process factors juxtaposed with supporting conditions, which act, in effect, like forces upon an innovation effort that can still be conceptualised as essentially serial in nature. Similarly, Goffin and Pfeiffer (2000) propose that innovation can be managed through three serial phases supported by two systemic factors. Their Pentathlon Model (Figure 2-2) proposes a more holistic approach to innovation management than the traditional processual approach.

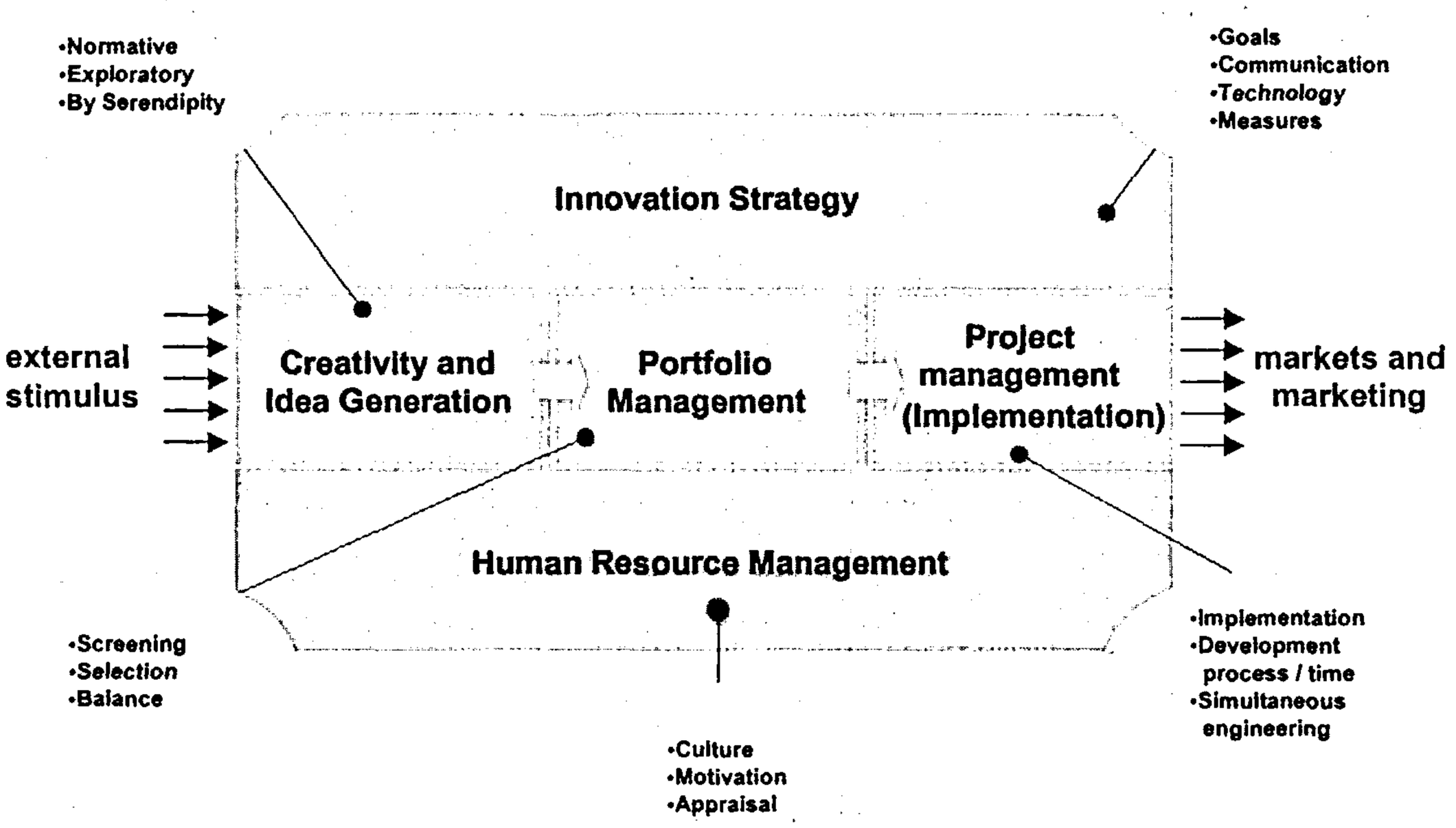


Table 10-3: The Innovation Pentathlon (adapted from Goffin and Pfeiffer, 1999, 2000)

The Pentathlon Model was developed following the analysis of nearly 200 high performing companies in the electronics and engineering sectors in Germany and the UK. The research was founded upon an earlier finding that many organisations misunderstand the role of innovation, have too many development projects and perceive innovation to be a single discipline – the rite of a research and development department.

Their analysis revealed that organisations would benefit from considering innovation and the dynamic interplay between the five key factors presented in Figure 2-2. They proposed that three phases can be used to translate stimulus and ideas into the injection of innovations onto the marketplace. They found that stimulating good ideas, which address customer requirements, is crucial, thus creativity and ideas management is essential to the innovation effort. Furthermore, they found since innovation includes new products, services and processes, the scope for ideas is

wide and therefore all employees should be involved. Once ideas have been generated, organisations need an efficient process to choose those with the highest potential as resources are always limited. They found that leading companies ensure that their innovation portfolio contains a good balance of new products, processes, and business and service innovations. The final phase 'project management' refers to the capability to quickly turn selected ideas into new products, services and processes. Claiming that good project management enables fast time-to-market, high product quality and acceptable development costs, they state that companies should look to introduce state of art practices, particularly including the use of cross-functional teams.

Goffin and Pfeiffer (1999) note that this process is wrought with problems; this is why they state that innovation strategy should decide the technology focus, communicate the role of innovation within a company, and drive all performance improvements and innovation targets through appropriate performance management techniques. Moreover, they claim that the ole of human resource management should underlie all innovation effort, as it is needed to create and support a culture in which employees are motivated to contribute to innovation.

Although the Pentathlon Model asserts that the five constructs should be viewed as interdependent, Goffin and Pfeiffer (1999 and 2000) fail to significantly elaborate on this point; with little regard for the interaction of these features with the external environment. Moreover, where they gain in the introduction of the systemic features to the issue of innovation, they lose in reducing the phases of innovation to three over simplified constructs. Furthermore, their approach to portfolio management is not comprehensive; Cooper et al. (2001) and Hamel (2000) propagate significantly more sophisticated approaches. Nonetheless, the Pentathlon Model maintains a qualitatively different perspective to innovation than that of its processual counterparts. It represents a more holistic approach to the issue of innovation and its management, and offers a more dynamic picture than that provided by Adam' (2003) framework.

It seems that an effective holistic approach to innovation management must include the high-level processual features of the innovation effort, dynamically combined with the structural and social factors within an organisation, which places importance upon the integration of the external environment. Such a conceptual framework should aim to adopt a stance similar to that proposed by Jelinek and Schoonhoven (1990), from which the constructs are viewed as interwoven, interdependent and mutually involved.

Appendix 2: Supporting notes for the research methodology chapter

Research strategy

> The research will use a mixed research strategy across three phases <

Defining the perspective and purpose of a study helps in deciding which strategies to adopt when collecting and analysing empirical evidence (Robson, 1993). Robson (1993) identifies three traditional strategies: experiments, surveys and case studies (summarised in Table 3-3).

Traditional research strategies	Key Characteristics
Experiments "Measuring the effect of manipulating one variable on another variable."	"Typical features: selection of samples of individuals from known populations; allocation of samples to different experimental conditions; introduction of planned change on one or more variables; measurement on small number of variables; control of other variables; usually involves hypothesis testing."
Survey "Collection of information in standardised form from groups of people."	"Typical features: selection of samples of individuals from known populations; collection of relatively small amount of data in standardised form from each individual; usually employs questionnaire or structured interview."
Case Study "Development of detailed, intensive knowledge about a single 'case', or of a small number of related 'cases'."	"Typical features: selection of a single case (or a small number of related cases) of a situation, individual or group of interest or concern; study of the case in its context; collection of information via a range of data collection techniques including observation, interview and documentary analysis."

Table 10-4: A summary of the three traditional research strategies (Robson 1993:40)

This section of chapter 3 will consist of a four further parts. A consideration of the three research strategies will be presented. Methods for ensuring academic robustness and industrial relevance will be discussed. Consideration of qualitative vs. quantitative approaches will be given. Finally a summary of how this understanding can be bought together to form research strategy that will satisfy the objectives of the current investigation will be presented.

Deciding upon the appropriateness of the different research strategies

In deciding the appropriateness of the different research strategies, Robson (1993) states three issues must be considered:

- The type of *research questions* that are being asked.
- The *control* required *over events*.
- The *focus* on *contemporary* events.

Research questions:
Yin (1994) considers that the most influential method for determining the correct strategy for an enquiry is the type of research questions asked in a study i.e. "how", "why", "who", "what", "where", and "when". In the first phase of the current study, the researcher will aim to discover what are the key enabling and inhibiting factors of disruptive innovation. "What" questions in an exploratory context lend themselves to any of the strategies describes in Table 3-4 (Yin, 1994; Robson, 1993). According to the Robson (1993) and Yin (1994) the "why" and "how" questions such as those that will be posed in the descriptive phase of the research are best suited to either the experiment or case study strategy.

Control over events:
For experimentation, the researcher is required to have a high degree of control over events (Robson, 1993; Yin, 1994). The phenomenological perspective eliminates experimentation as a research strategy for the current study as the inquiry is concerned with understanding disruptive innovation in its natural setting. Exercising control will disrupt the very reality that the research is trying to explain. The researcher is not required to have control over events in either the survey or the case study strategies, thus both are considered suitable.

Contemporary focus:
To develop and test an understanding of disruptive innovation the current study will use a varying focus on both contemporary and historical events. The literature (Robson, 1993; Yin, 1994) shows that this approach does not eliminate any of the research strategies outlined in Table 3-4, however, it does highlight surveys and case studies as an effective strategy.

The analysis of the above three issues indicates that the case study and survey strategies are best suited to the current research. The use of these throughout the three waves of the investigation can be underpinned by a comprehensive knowledge of the literature to satisfy the research objectives (Figure 3-3).

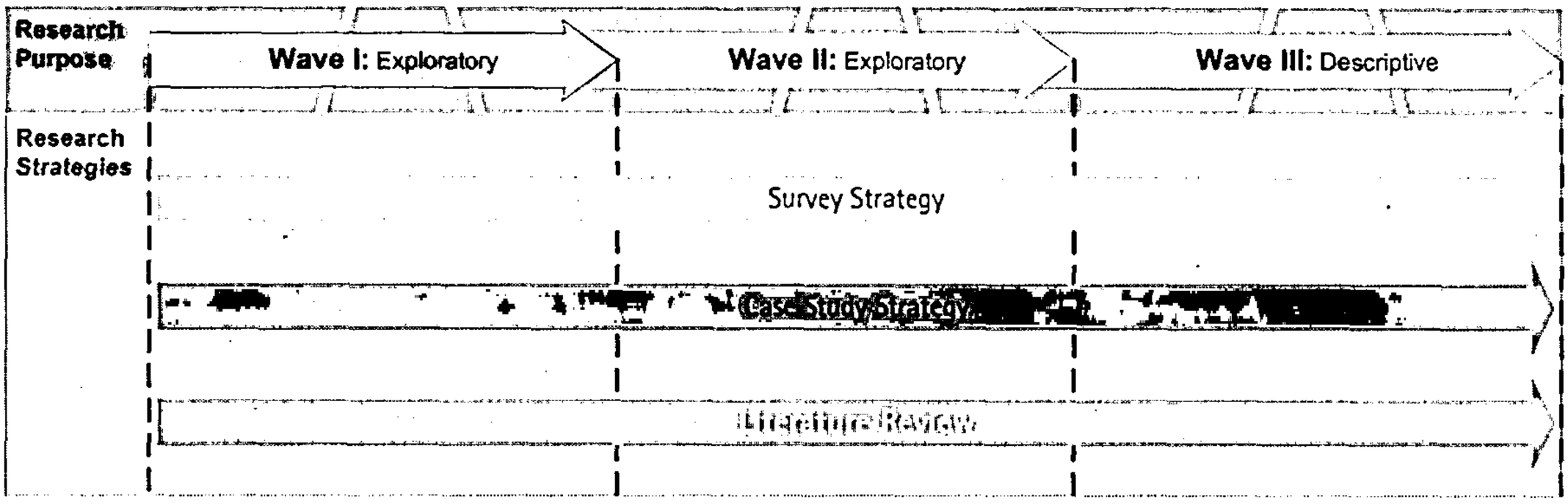


Figure 10-3: The use of research strategies in the current investigation

Deciding upon a quantitative or qualitative focus

> Qualitative and quantitative data have been gathered using a multiple method data collection approach <

There are two types of research data that can be collected: quantitative and qualitative. Quantitative data is based on meaning derived from numbers; its collection results in numerical and standardised data (Silverman, 1999). Once collected it is analysed through the use of diagrams and statistics (Robson, 1993; Silverman, 1999). The quantitative approach is often deemed as the 'scientific approach' (Robson, 1993) as it is synonymous hypothesis testing, involving experiments or other forms of empirical enquiry.

Qualitative data is based on meanings expressed through words; its collection results in non-standardised data requiring classification into categories (Silverman, 1999). Data collection and analysis, conducted through the use of conceptualisation, can happen concurrently (Robson, 1993; Silverman, 1999). The qualitative approach allows theory and concepts to arise from the inquiry, coming after and during data collection rather than before (Robson, 1993). The research often deals with human issues, for instance reflecting on the life of individuals, groups, societies and organisations, and is conducted through contact with 'field' or 'life' situations (Miles & Huberman, 1994). The researcher may often start with a tentative research question, concept or constructs and allow an initial period of research to assist in developing hypotheses (Robson, 1993). Thus the

quantitative and qualitative approaches impact the researcher and the research strategy in different ways (Table 3-4).

Aspect of Research	Quantitative	Qualitative
Relationship between researcher and subject	Distant	Close
Research strategy	Structured	Unstructured
Nature of data	Hard & Reliable	Rich & Deep
Relationship between theory and research	Confirmation	Emergent

Table 10-5: Comparison of quantitative and qualitative research methods (Bouma & Atkinson, 1995)

Appendix 3: The Case Studies

Case A: Overview

The following details provide an overview of Case A's position in December 2001:

CASE A:	Manufacture.
LOCATION:	France.
SIZE (Turnover):	€ 7.0 million per annum.
SIZE (employees):	110 full time equivalents.
BACKGROUND:	In France in 1992, the world's leading bicycle helmet manufacturer opened Europe's first factory dedicated to the manufacture of bicycle helmets. In 1999, the French manufacturer gained its independence and Case A was born. The parent had decided to relinquish control of manufacturing - to focus purely on design and sales activities and to allow other plastics moulding firms to tender for its business. In December 2001, Case A's parent company remained a major customer. Independence generated new opportunities and threats for Case A and in an attempt to broaden their activities from bicycle helmets they began to consider the business differently. Firstly, they wanted to be recognised as a European authority in protective helmet design and manufacture. Secondly as they wanted to be European experts in thermo forming, expanded polystyrene moulding (Figure A-1), die cutting foams, fabricated foams injection moulding tool design and manufacturer and sub assembly contracting. This repositioned Case A into the worldwide domain of custom plastics manufacturing.

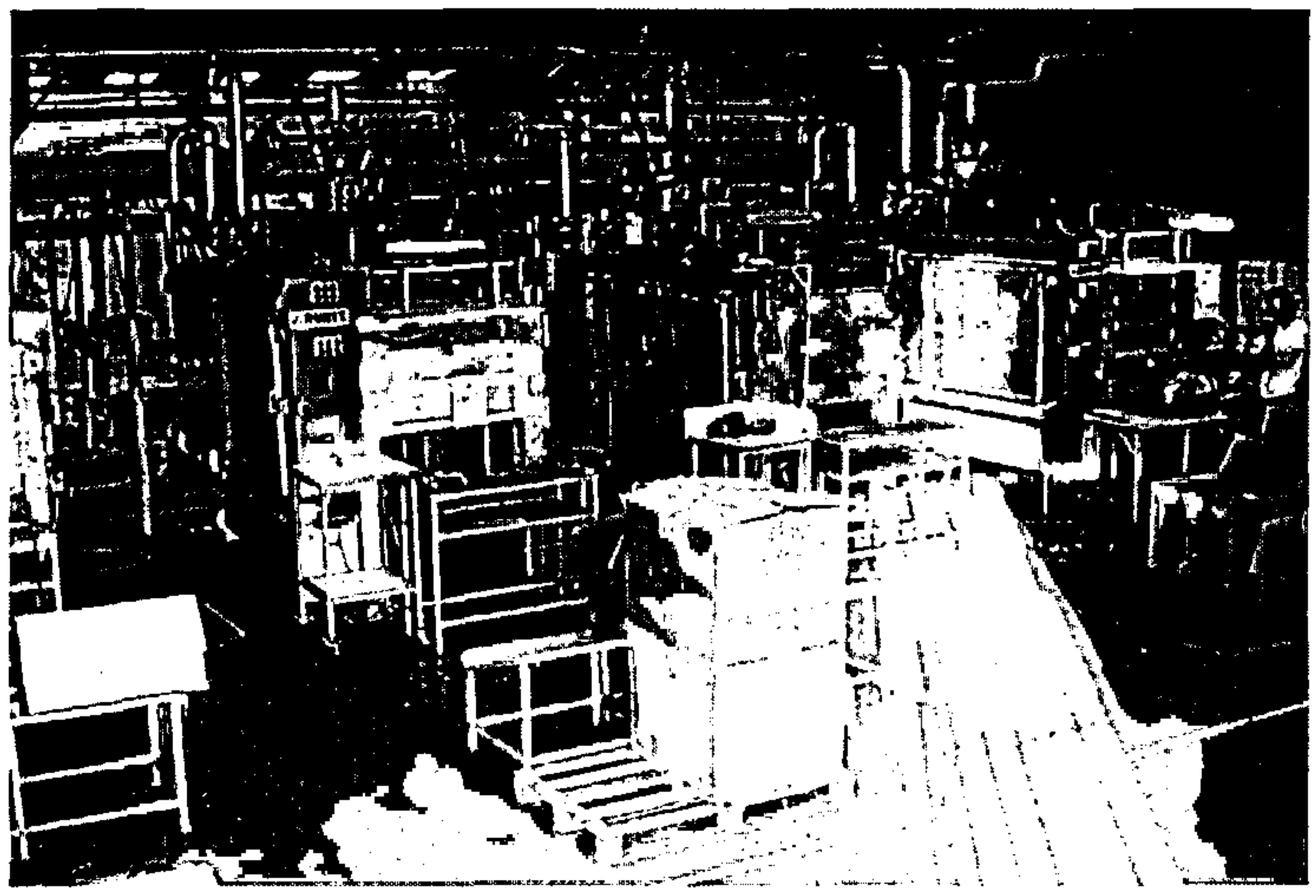


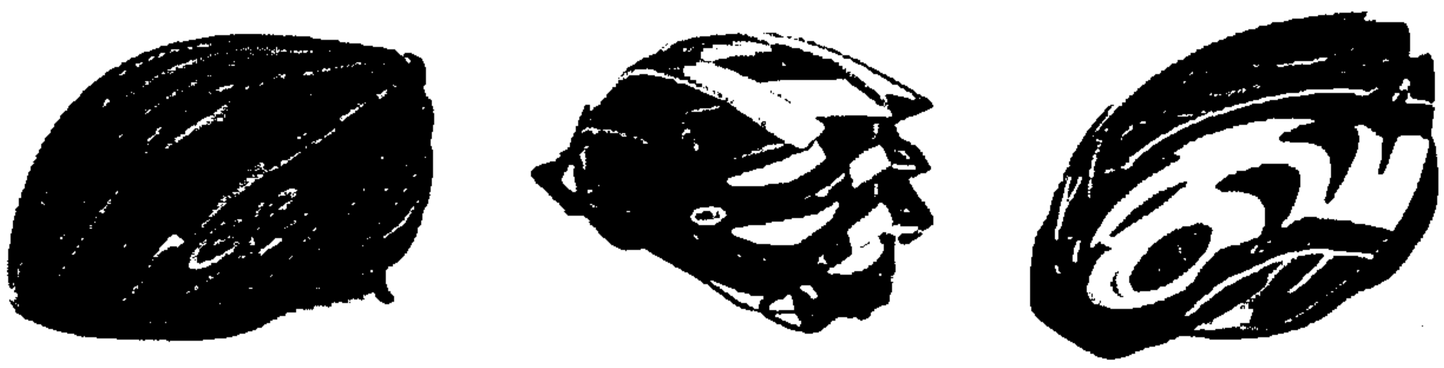
Figure A-1: Case A's expanded polystyrene injection machines.

Case A began to make headway into the custom mouldings arena, successfully capturing a small number of contracts for simple products such as wine pack boxes. However, limited commercial experience meant that diversification into new markets was not as easy as anticipated. Thus, the senior management team decided to refocus much of its efforts into familiar areas - the manufacture of protective helmets. Soon after, new customers in the protection helmet industry were found (not just in the bicycle sector), these almost completely offset contract losses from their former owner.

In 2000, Chinese manufacturers made a rapid large scale entry into the already competitive worldwide market of protective helmets. This had an instant impact upon Case A's sales, significantly reducing their market share and generating a huge threat for the firm's existence. Just a few years earlier, Chinese helmet manufacturers had operated on the periphery of the market and were almost non-existent. However, by offering products of marginally less quality but at significantly less cost, they had effectively begun to disrupt the protective helmet industry using a low-end disruptive strategy.

REASON FOR	Case A's executive management team conducted a review of product

INVOLVEMENT:	offerings, past and present, *within* its core market - the protective helmet industry. They generated two conclusions: 1) Although Case A's core market had moved forward, it had essentially remained the same for several years (Figure A-2) and now competitive advantage was firmly focused upon cost reduction.



GIRO Stelvio (1997) BELL X-Ray (2000) LAZER X3M (2003)

Figure A-2: The core products manufactured by Case A - 1997 to 2003.

2) Case A was nearing the end of its capacity to compete on price within its core product range. It needed to generate new areas of competitive advantage and saw the rapid introduction of innovation to the top of the management agenda as crucial for the firm's permanence.

Case A's Director General *understood* they will never again be able to compete in the lower-level and mid tiers of the protective helmet market. In addition, incremental innovation at the high-end was delivering diminishing returns on investment. He made the decision that the firm needed to develop competencies beyond *incremental* innovation. It had to now embrace radical forms of innovation and better understand the phenomenon of disruption, "... this perhaps will be our only way to survive." (Director General Case A)

CONTRIBUTORS:	All five members of Case A's executive management team have been involved in the current study to varying degrees. Particularly high involvement has been seen from the Director General (who has a rich international executive management experience and has overseen numerous international product development projects) and the head of Quality and R&D (a plastic and composite materials engineer, who

has project managed many of Case A's new product development initiatives within the protective helmet sector).

Case B: Overview

The following details provide an overview of Case B's position in December 2001:

CASE B:	Manufacture.
LOCATION:	Israel.
SIZE (Turnover):	€2.5 billion per annum.
SIZE (employees):	Approximately 14,400 full time equivalents across the whole enterprise.
BACKGROUND:	Case B is a government owned manufacturer with an intensive focus on research and development (R&D). In the last two decades, Case B has witnessed significant changes. It has expanded design and sales activities from its home nation markets to the global, worldwide level. It has enjoyed success and growth, and is now considered to be one of the world's leading firms in the conception and manufacture of aeronautics, aerospace and electronics equipment for the military sector (Figure B-1).

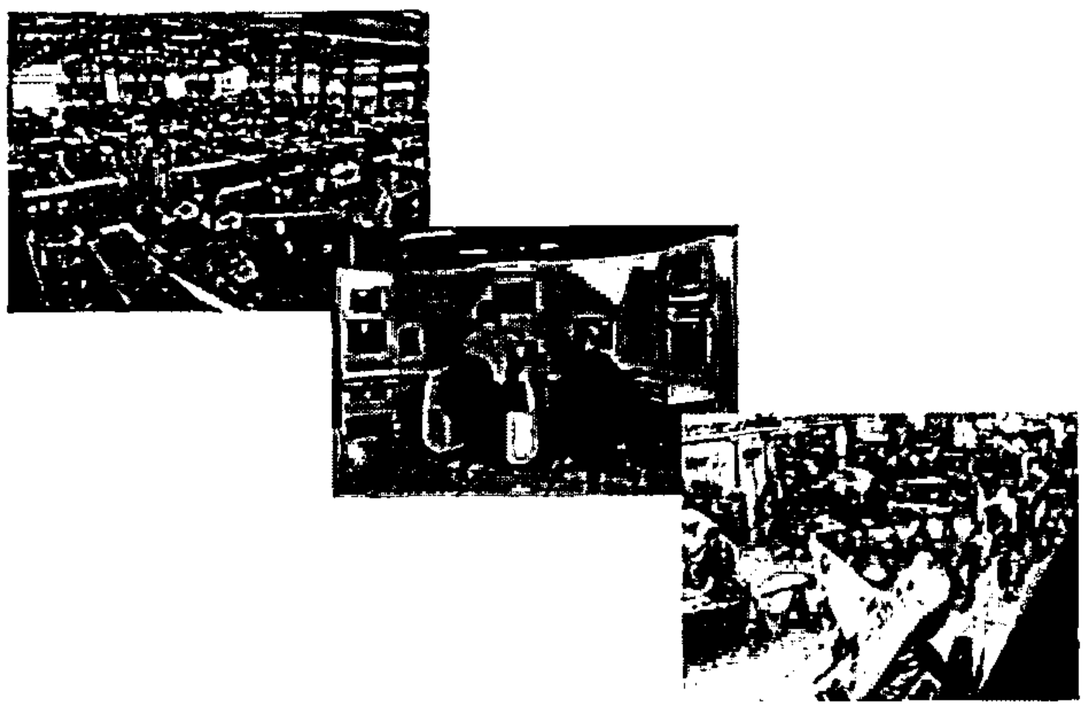


Figure B-1: Case B, a global leader in military hardware.

Case B has also developed a strong presence in the global military market for the conception and delivery of software engineering, embedded computer systems, advanced electronic navigation systems and optronics (Figure B-2).

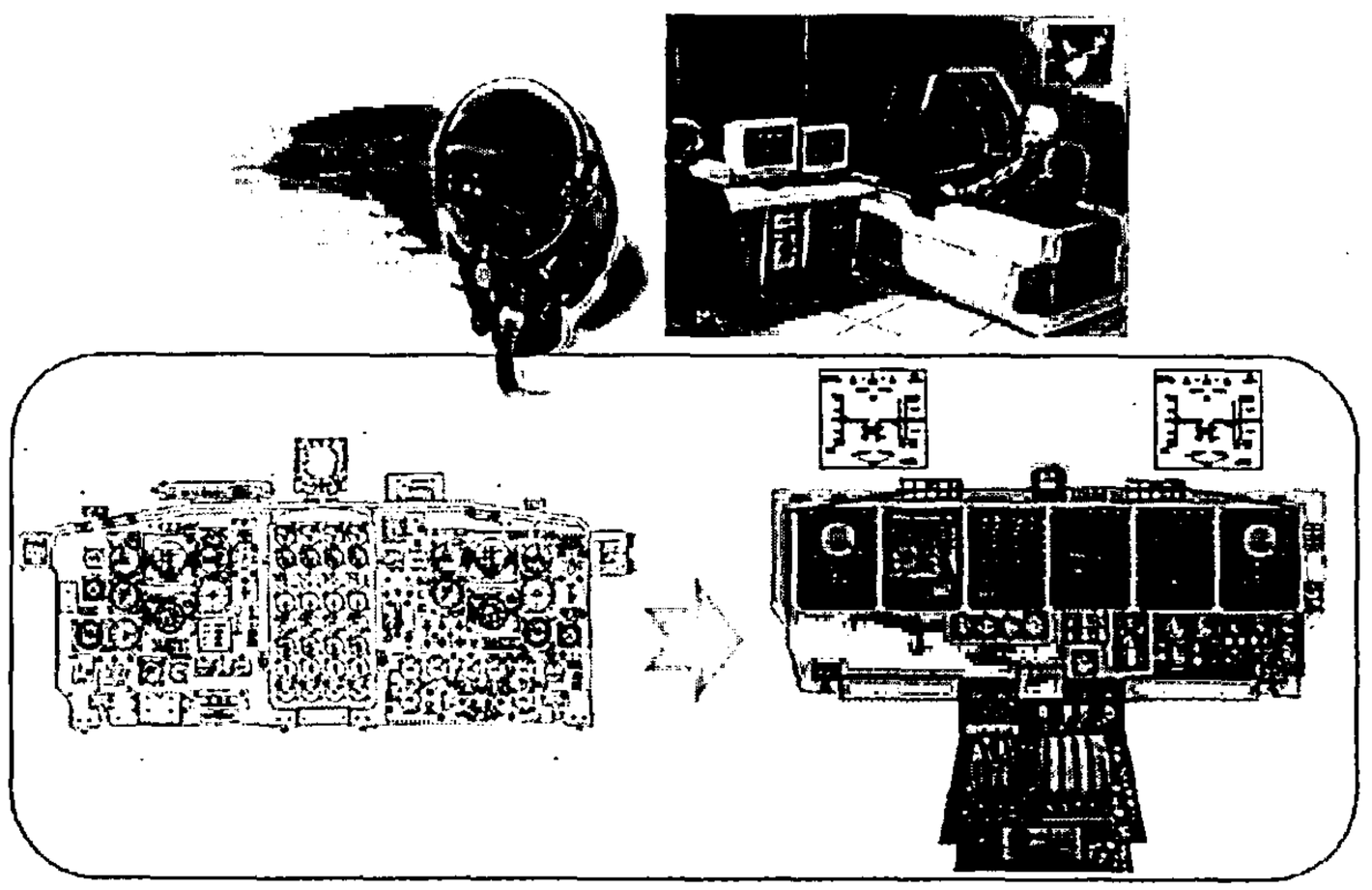


Figure B-2: Case B, a global leader in military software.

By the end of the 1990's, competition within Case B's core markets had intensified. Growth rates had slowed and in some divisions they had almost stopped. To combat reduced growth, Case B launched two major initiatives: the Systems and Software Process Improvement Programme (SPIP) and the Competitiveness Improvement Programme (CIP).

SPIP was an initiative lead by the Director of Corporate R&D and Business Development Embedded Computer Systems. To improve competitiveness, it focused on incrementally improving internal processes. The focus of CIP was different. It was an initiative led by the Chief Operations Officer and the divisional Vice Presidents of R&D, to create a company wide improvement of general innovation capabilities. It focused upon improving the effectiveness of R&D activities and the identification of new revenue streams. Particular

	attention was given to radical new product development, the decisive success factor of arriving first to market, and tentative steps into investigating commercial, non-military domains. In 2001, both programmes were recognised to have delivered success but the future still looked uncertain and growth rates had not drastically improved. Accepting the need to lead an intensive company wide improvement in performance, Case B's executive management team initiated a corporate change initiative. A new mission statement was written and four core values were identified. Case B now had a 'Technology and Innovation Value': "We will encourage all the people in [Case B] to seek innovative ideas in everything that we do. Our technology edge is a foundation for satisfying customers and for our growth".
REASON FOR INVOLVEMENT:	Case B has primarily involved one of its key divisions in the current research; it is a typical division within the firm. In the 1980's, most of its people were engaged in designing new cutting edge technologies for its rapidly growing market base, which in the subsequent years have become the focus of sustaining innovation. The division has concentrated upon exploiting the knowledge that it created and is now a world leader in the field of operational upgrades of fighter and trainer aircraft. The problem the division now faces is one of diminishing returns on their prevailing knowledge and technology base. The need to identify new business and technology opportunities has emerged into a primary objective and search for innovation has begun. It was the opinion of two Divisional R&D Vice Presidents that this division of Case B was much like the rest - excellent at delivering incremental improvements to existing offerings and rapidly imitating market pioneers. However, it lacked the ability to identify and capitalise upon breakthrough or disruptive innovations. Therefore, the primary reason for Case B's involvement in this

	research project was to address their gap in knowledge. Through being involved, they hoped to deliver a better understanding of disruptive innovation and how it can be enabled. They intended to diffuse this knowledge throughout the core business areas to enhance the firm's capability to quickly identify disruptive opportunities, from both external and internal sources, especially those in the increasingly attractive non-military fields.
CONTRIBUTORS:	This research has benefited from two types of Case B contributor. The first group consists of six people, who have provided regular contact with rich involvement. Of these six members, three hold executive level positions and three are senior engineers. The second grouping of contributors – consisted of approximately 90 people, consisting of functional managers, senior engineers and senior commercial staff, who attended a series of four one-day workshops held on site at Case B in Israel.

Case C: Overview

The following details provide an overview of Case C's position in December 2001:

CASE C:	Service provider
LOCATION:	Head offices in Sweden, operating in 24 countries.
SIZE (Turnover):	SEK 134 billion for the year
SIZE (employees):	
BACKGROUND:	Case C is an international financial services and insurance group, established in Sweden in 1855. In December 2001, the company had SEK 833 billion in assets under management and was ranked within the world's top ten largest insurance companies in the Fortune Global 500.

Case C is an example of a disruptive innovator. During the 1980's, it experienced rapid growth that transformed the financial services sector. A business model innovation revolutionised the company from a traditional national firm to a global leader. It accomplished this feat by pioneering the use of the 'extended enterprise' within the financial service market. Case C developed and implemented new organisational and technological structures to maximise the sharing of knowledge across local business units and partners. By using a new type of business model it became a specialist in inter-organisational co-operation. Its traditional integrated supply and value chain was replaced with a 'virtual organisation', consisting of independent money managers and distributors from across the world (Figure C-1).

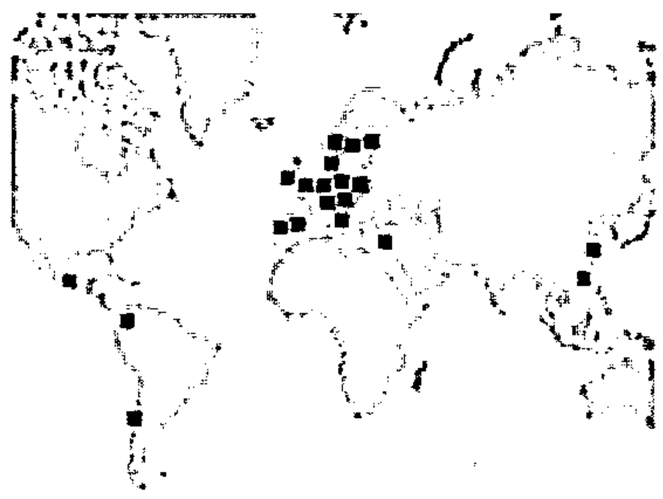


Figure C-1: Case C, a global virtual organisation.

Case C had undergone significant business model innovation. The virtual business model could was one of the first to realise the benefits of networked operations, making the network much more valuable than the individual parts. Consequently, Case C needed to invent new ways to report the value-creating potential of its virtual organisation and became the first company to describe and quantify the difference between its market value and its book value. It developed new tools and business management models to provide a more balanced, true picture of operations – a balance between the past, the present and the future. Many of these tools and

	approaches have themselves become income generators and are sold in the form of consultancy and software to organisations around the world. Since its disruption of the financial services market, Case C claims to have been looking for the next big changes in the sector. It has utilised an 'incubator' approach to provide seed funding for new service innovations, sometimes in spin-out organisations, to develop them into the potential new business models of the future. These efforts have realised the creation of a number of small service offerings but to date, have not succeeded in delivering any significant breakthroughs. Despite its pioneering approach, by the 1990's, Case C had lost its unique position. On witnessing the success of the virtual organisation, the rest of the world's major financial service and insurance companies rapidly copied and replicated the new 'best practice' business model. In December 2001, Case C was regarded by its industry to be an effective innovator, with a lead-time of less than one year for developing and introducing new products (in the form of service offerings). However, this could be matched by many and even bettered by some of the competition. Worse still, their competitors had squeezed costs from the virtual organisation businesses model, where Case C had failed to do so, whilst at the same time making shrewder investment decisions, thus outperforming the one time disruptor.
REASON FOR INVOLVEMENT:	Case C recognises that their disruption of the financial services sector was not based upon premeditated action but upon a number of sequential acts of serendipity. It historically understands the benefits of delivering disruptive innovation but lacks the understanding and ability to become a second time disruptor. Their competitors are continually reducing costs and prices and Case C are aware that their performance improvements have reached the point

	of diminishing returns. Despite its strategic intent to find and capitalise upon the next financial services breakthrough, Case C admits that it has lost its way with innovation. Formal channels for collecting and building radical ideas have all but closed and the organisation has issues with its ability to scale up its seed funded projects. Furthermore, it needs help to better identify the difference between new small niche opportunities and potentially disruptive innovations. They joined this research hoping to develop a better understanding of what disruptive innovation is and how it can be enabled. Furthermore, they wanted access to a network of non-competitive organisations who share in the same struggle to pursue wealth creating industry disruptions.
CONTRIBUTORS:	Case C has primarily involved two groups of contributor to the research: 1) Two corporate level strategy advisors who have a global view of the business and a direct input to the boardroom. 2) A long serving group, consisting of a senior manager and her team of five staff, who have recently established an innovative new service venture seed-funded by corporate Case C.

Case D: Overview

The following details provide an overview of Case D's position in December 2001:

CASE D:	Service provider
LOCATION:	Head offices in Spain with subsidiaries in France and Portugal.
SIZE *(Turnover)*:	€ 3.9 million for the year

SIZE (employees):	56 employees.
BACKGROUND:	Case D was founded in 1989 as a small industrial design studio with 2 designers. By December 2001, the firm had evolved into a SME with 56 employees divided over its three divisions in France, Spain and Portugal and a turnover that had increased in size by more then 100% per year in the preceding 5 years. Case D's business activities have evolved from its start point as a design studio. The firm now offers a range of services to industrial companies covering the whole cycle of product development. This includes: product briefing, concept development, concept and detailed design, engineering, prototyping, mould manufacturing co-ordination and innovation strategy and management. In December 2001, Case D boasted more than 70 different industrial clients from a high variety of sectors such as: furniture, toys, white goods, computer printers, home use tools, industrial tools, banking (pay dispensers and cash machines), ticketing devices, hospitals (information poles), industrial machinery, bathrooms & WC manufacturers, and machine control devices (Figure D-1).  *Figure D-1: Case D, A consulting firm that provides competitive advantages to its clients through product innovation, development and optimisation.* The success of Case D's integratable product development services is based upon highly responsive co-operation and communication

	between the firm and its clients. This strong client-relationship focus has provided Case D with extensive experience and practical know-how of industrial product development cycles. Case D now leads the market in its home nation of Spain. The executive management of Case D have recognised that firms of comparable size and competency in the British, north American and German markets are unable to command such market shares in their home nations. This is because the industry is more mature and established within these countries. Hence Case D is not yet recognised to be a significant multi-national player in the arena of design and product development consultancy. The world's most recognised design firms dominate the high revenue European market and are seen as the benchmark to beat. Case D understands that it has a long way to go before it can attract the clientele and the revenues of these market leaders. However, Case D's management intends to maintain the vigorous growth of its knowledge and experience base and are determined to maintain the rapid growth of revenues – they want to become a major contender in the European market.
REASON FOR INVOLVEMENT:	Two years ago, to address Case D's desire to become a leading European design and product development consultancy, the organisation created a new division – the 'innovation group'. The team intended to provide its clients with new visions and something that no other consultancy was offering: disruptive future product plans. However, the two year experience unearthed four critical findings for the firm: 1) Within Case D, there was significant misunderstanding surrounding the term disruptive innovation. 2) Within the management teams of Case D's clients, there existed an almost total lack of knowledge on disruptive innovation. 3) There was a lack of pragmatic and easy methods for generating,

	scanning for and identifying new disruptive product opportunities. 4) Conventional market research methodologies were not sufficient to detect new wealth-creating innovations – they disabled the ability to create a stronger position for the long term future of the a client company. Case D joined this research because it considered a deeper understanding of disruptive innovation to be essential for delivering competitive advantage and to fulfil its growth targets.
CONTRIBUTORS:	The primary contributors, involved in the current research from Case D, are the members of the aforementioned innovation group. This team possess a wealth of experience in the areas of product design and new product development. The entire group has been involved to varying degrees. The most regular and rich involvement has been with the head of the division and one of his senior consultants.

Appendix 4: Data Analysis - How coding evolved through-out the investigation

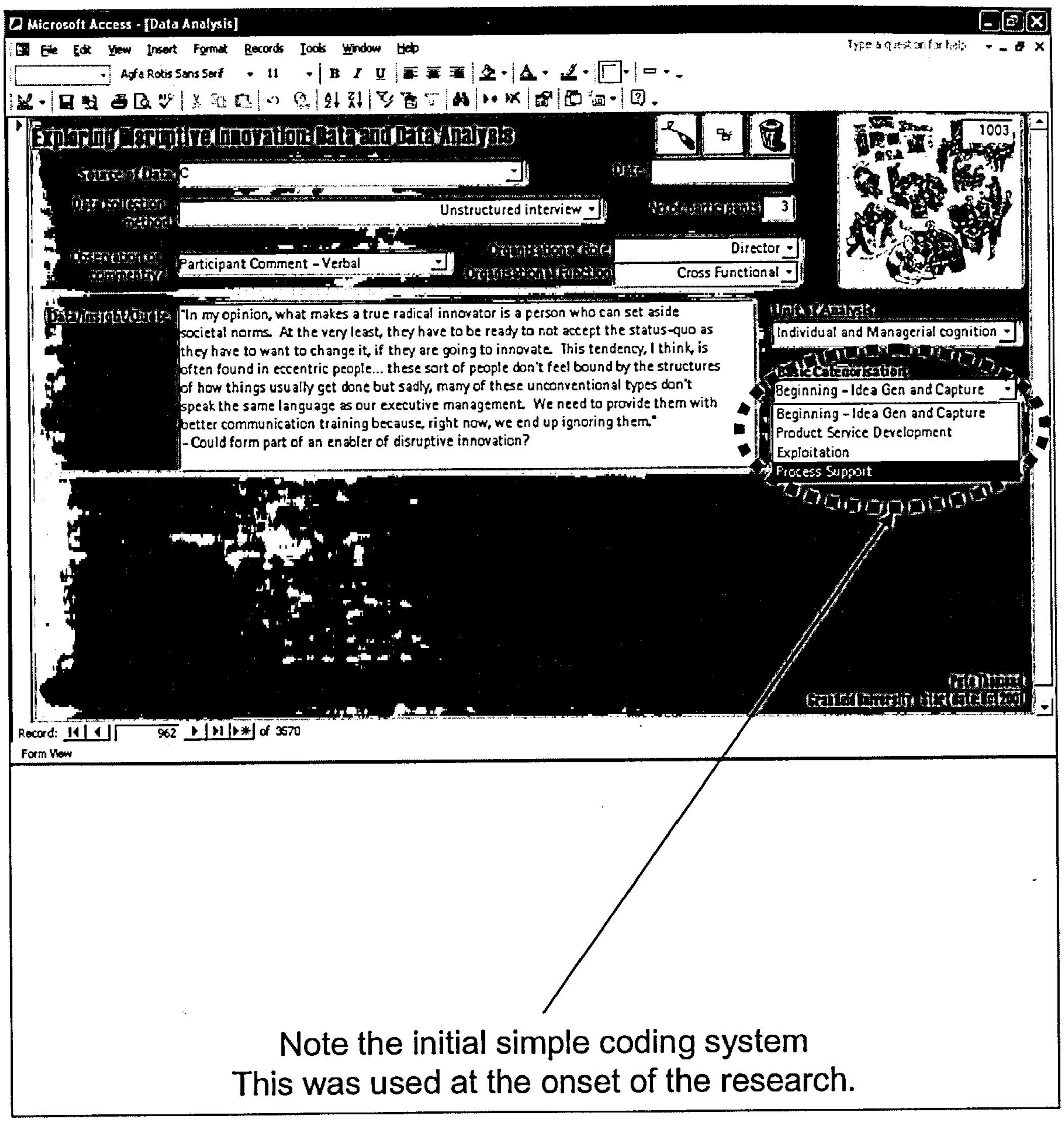
From the outset of the data collection, an open coding approach (Strauss and Corbin, 1997) enabled the author to categorise field notes, transcripts and other material into patterns, themes, concepts and categories. In accordance with Strauss and Corbin (1997) the coding system was refined as the data collection proceeded; the use of a database facilitated this process

Examples of field notes taken using the split-page technique

Inserted after this page is an example of a page of field notes take from an interview with the COE of Case A in August 2002.

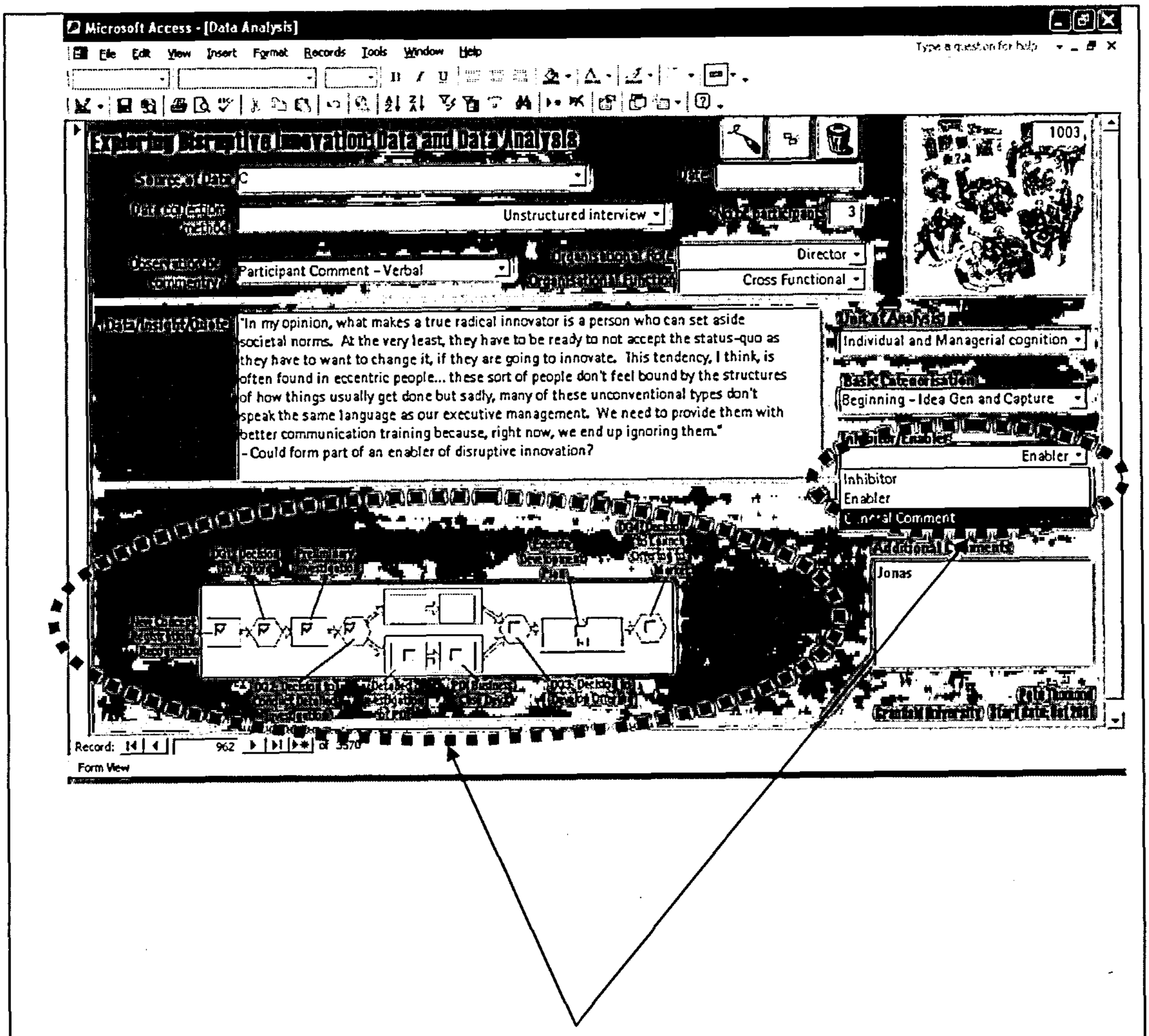
Examples of the data analysis – evolution of the database

Inserted after this page is are examples of screen shots from the database established to help with data coding and analysis. Three pictures are presented to illustrate the evolution of the database in line with the progress of the research.



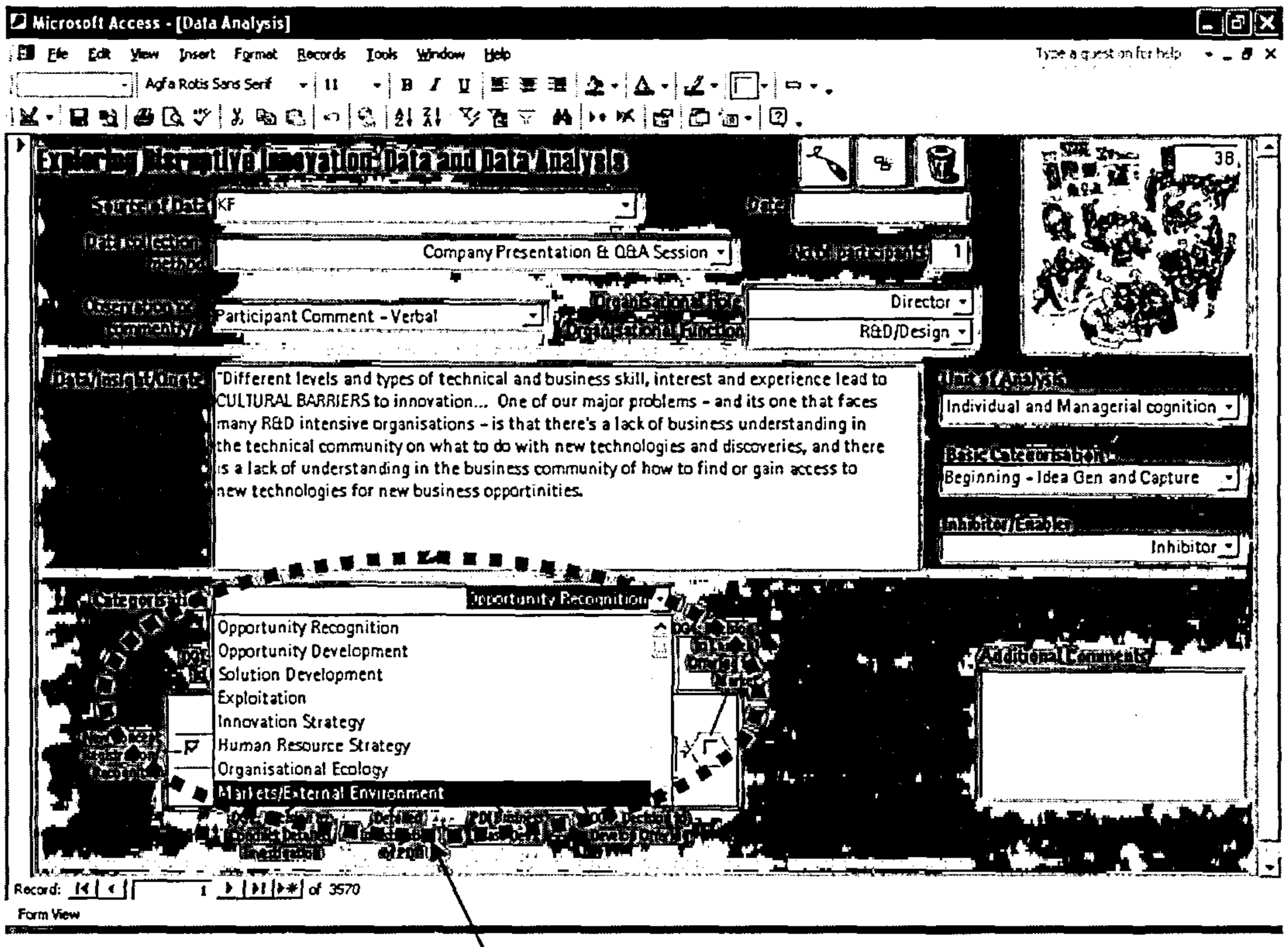
Note the initial simple coding system
This was used at the onset of the research.

The first iteration of the data analysis and coding database



Note the introduction of more complex data coding system – based a a processual view of the pursuit of disruptive innovation. Also note and introduction of the categorisation of data into the 'enablers' / 'inhibitors' concept

The second iteration of the data analysis and coding database



Note the introduction of the processual and systemic coding system. It was from this coding that frequency counts were made regarding the enablers and inhibitors within each construct. The three more frequently mention enablers and inhibitors for each eventually formed the conceptual framework presented in Chapter 4.

The third iteration of the data analysis and coding database

Appendix 5: A description of the disruptive portfolio management intervention

The Disruptive Portfolio Management (DPM) intervention:

The primary aim is to tackle inappropriate funding routines by facilitating senior management to understand how their current mental models determine a fixed and narrow view of innovation as incrementalism. It aims to help managers to see how their current actions (which are driven by their cognitions) lead to the disregarding or mismanagement of potentially disruptive innovations. And aims to provide a context whereby new strategic intentions can be formulated and to offer the tools to turn these into strategic action

The Objectives of the DPM:

1. To help senior management to graphically see the whole innovation playing field –from incrementalism to disruption.

2. To facilitating the identification of potentially disruptive opportunities.

3. To facilitate senior management in legitimising the allocation of resources to potentially disruptive opportunities.

4. To provide senior management with best practice funding guidance

5. To help prevent projects with a dominant history or dominant people from soaking resources away from disruptive opportunities.

6 To show how the above objectives can be achieved whilst delivering best practice innovation management at all points in the new product, service, and process development cycle. (e.g. maximising benefits from investment into innovation, preventing project gridlock, delivery of strategic aims and a balanced focus between sustaining and potentially disruptive projects, long and short-term etc).

An overview:

The very latest understanding of 'disruptive innovation' and 'portfolio management' approaches have been uniquely combined to offer a solution to the crippling resource allocation problem. The "Disruptive Portfolio Management Intervention" consists of a workshop focused upon facilitating management practitioners to challenge their prevailing mental models of innovation and their

conventional funding routines. The output of the tool can also be used to communicate any priority changes throughout the business.

The unique approach provides practitioners with a true 'big picture' of their organisations' innovation activity which will legitimise the simultaneous investment of resources into continued business success and the new fertile grounds of Disruptive Innovation.

Unlike other portfolio approaches, it takes advantage of the goals of portfolio management whilst also enabling a more easily justifiable investment into potentially disruptive projects. The tool is deployed through an interactive workshop with the senior management team responsible for innovation strategy and is supported by a software tool.

A focus upon financial methods within portfolio management are favoured by industry, however, these are shown to be the worst performing, in terms of delivering value, strategic alignment and balance (Cooper et al, 2001). Therefore, the DPM methodology uses a hybrid approach, or multiple portfolio method. A combination of strategic approaches (whereby business strategy determines "buckets" of money or resources and projects are selected because of their strategic importance), scoring models (whereby projects are rated on multiple criteria), and bubble diagrams (where projects are plotted on various X-Y axis on a variety of parameters) have been used

Graphically representing an organisation's portfolio of projects in this manner avoids a narrow, project-by-project decision making approach and allows a broadening of investment options with fewer missed opportunities. Users of the tool are facilitated to disrupt strategically. The deployment of the DPM is described in the proceeding section:

The DPM Process:

To help management teams to disrupt strategically the DPM process in implemented in four stages (Figure 5-1)

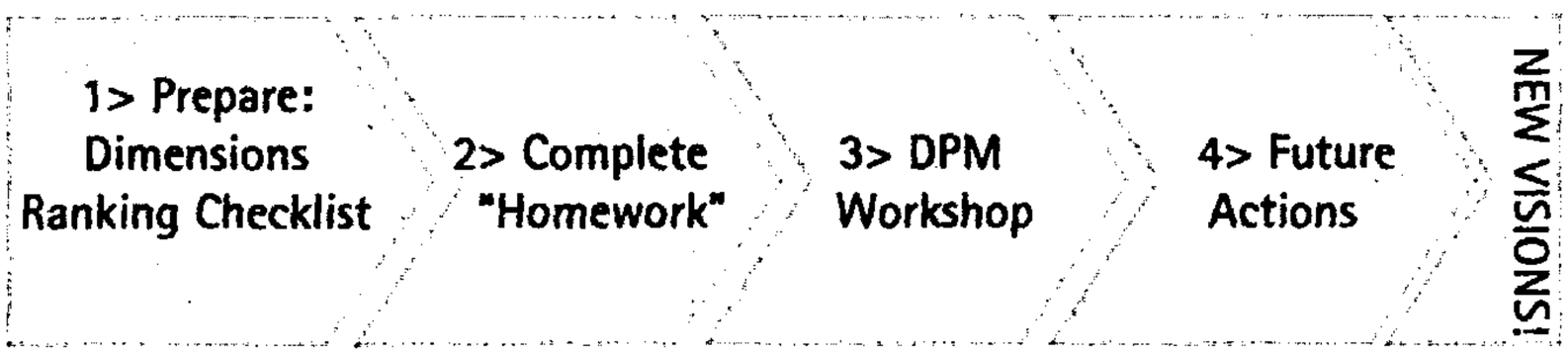


Figure 5-1: The Disruptive Portfolio Management Process

- *Phase 1: Prepare Dimensions Ranking Checlikists:*

The DPM is essentially an assessment and analysis tool, founded upon series of questionnaires called the dimensions ranking checklists (DRCs) (Figure 5-2). The DRCs have two objectives:

1) To assess the organisation's priority innovation initiatives using a series of standard PM measures (e.g. market feasibility, technological feasibility, benefit to the organisations, fit with strategy, etc), plus a cluster of qualitative and quantitative measures focused upon disruptive innovation.

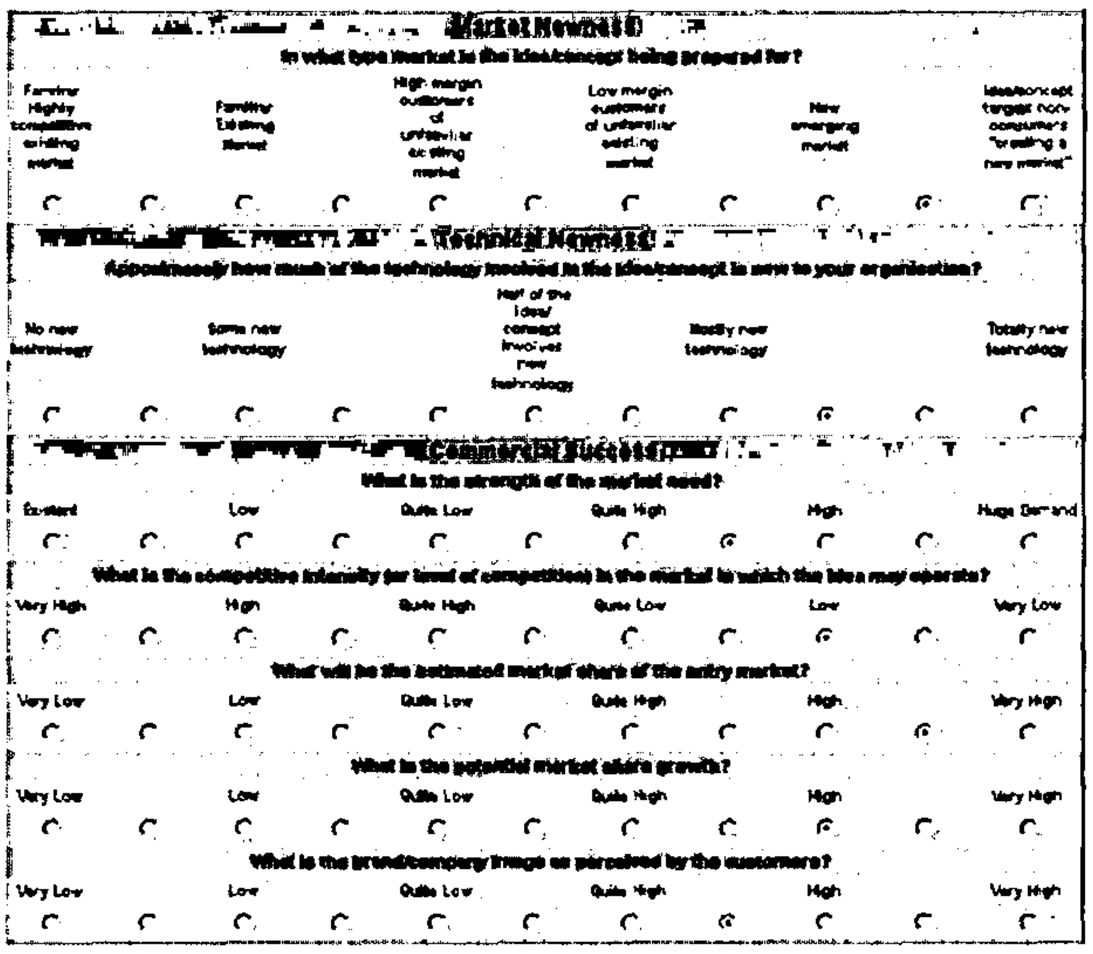


Figure 5-2: A small section of the Dimensions Ranking Checklists

2) To gauge the impact of the initiatives under consideration (e.g. incremental, radical, discontinuous or potentially disruptive); whilst providing an analysis of each initiative's current situation, in consideration of its stage of maturity, from early stage idea to advanced innovation project.

There are a series of DRCs to match the maturity of the initiative under consideration (Figure 5-3); the tool even provides a project management assessment for advanced developments.

- *Phase 2: Complete Homework:*

There are two types of homework:

1) The DRC assessments can be completed as 'homework' by the relevant project managers or R&D team. The assessors should select their organisations top ten high priority innovation initiatives, in any stage of development, and a small selection of recently killed initiatives for assessment with the DRCs.

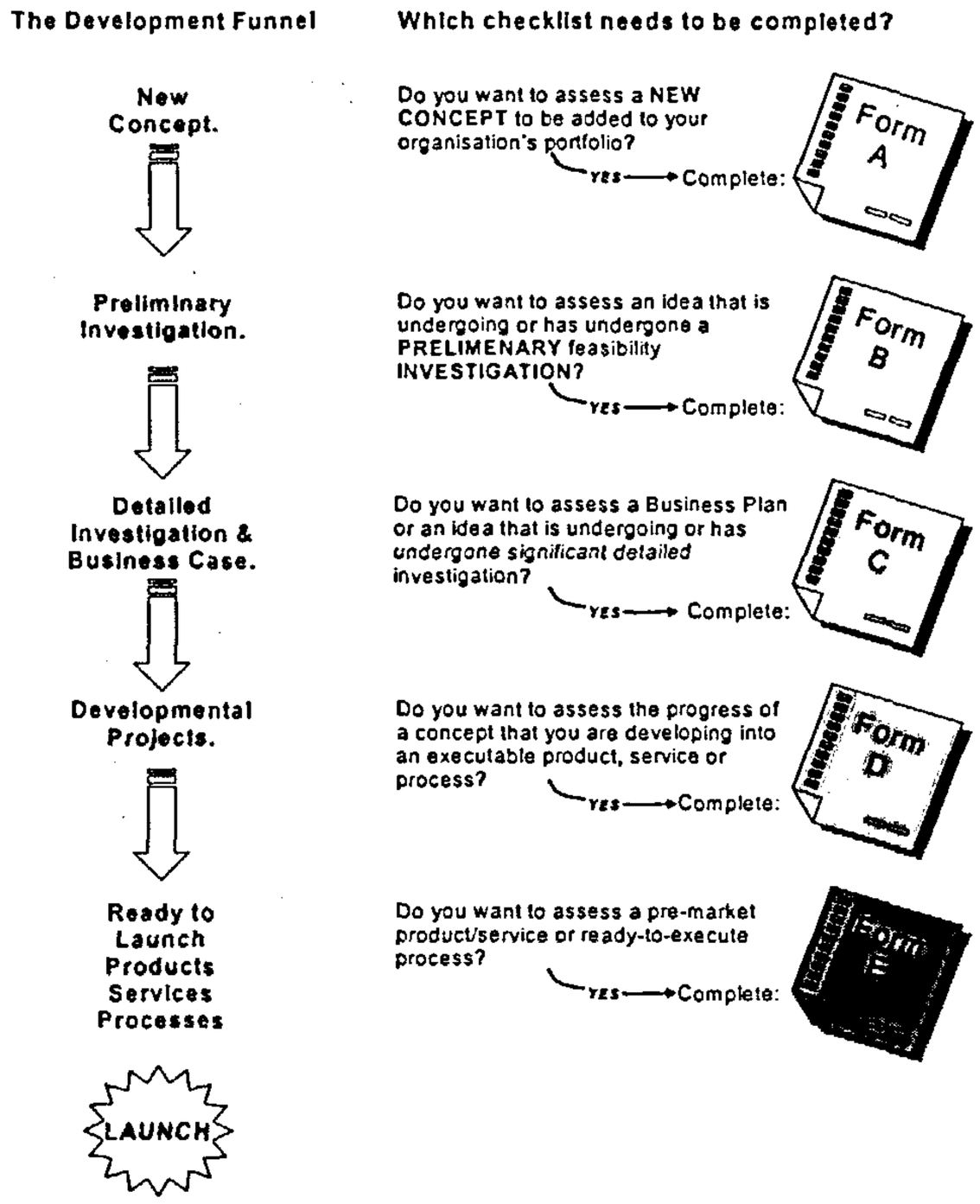


Figure 5-3: Which DRC to select?

2) The facilitator of the DPM process gathers this data (either manually or using the DPM Software) and plots it onto seven large scale portfolio maps or "Bubble Diagrams" (where projects are plotted on a variety of $1m^2$ maps using different parameters on the X and Y axis) . Four of the maps are standard portfolio management views and three are designed to specifically account for disruptive innovation. The aim is to present to the senior management team a holistic graphical representation of their portfolio's of priority innovation projects (Figure 5-4).

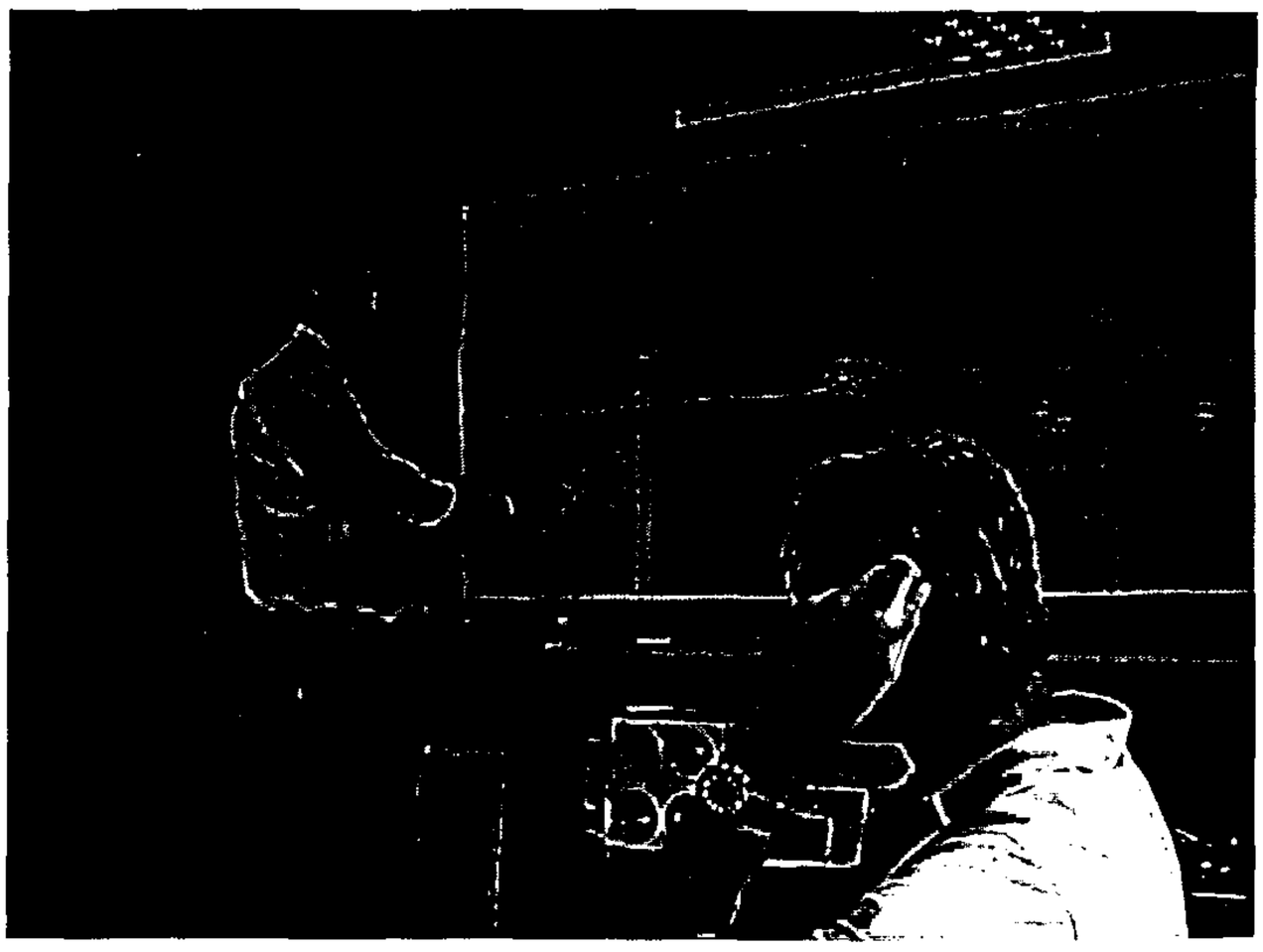


Figure 5-4: Presenting Case A 's Portfolio Maps

- *Phase 3: The DPM Workshop:*

The management team can choose a one or two day DPM workshop, which follows the agenda shown in Figure 5-5. The plotted portfolio maps are attached to the wall of the meeting room; the purpose of the workshop is three-fold:

1) To allow the facilitator to introduce or re-emphasise the concept of disruptive innovation to the participants (using the knowledge safari tool); these should be the full senior management team responsible for innovation strategy and formal resource allocation (during this process lessons learnt from case studies and funding strategies from venture capitalists are also discussed).
2) To allow the participants to be facilitated through an holistic analysis of the data from their portfolio maps.
3) To facilitate the management team to see how their prevailing mental model of innovation has impacted resource allocation and therefore influenced the firms actual strategy.

See Figure 5-6: A break-out group discusses the dangers of focusing its innovation effort in one quadrant of the portfolio map.

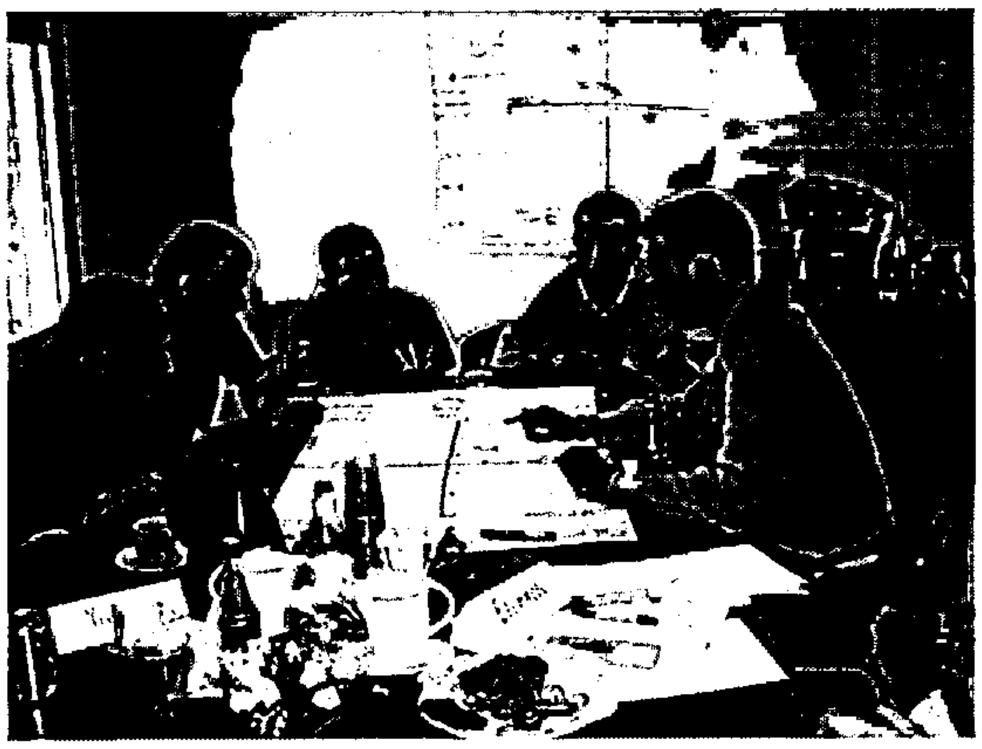


Figure 5-6: A DPM break-out group

Two day Version Time	One day Version Time	Activity
08.00:	08.00:	Stage 1a: *Introductions and* establishing objectives, agenda, roles, and rules. Stage 1b: "Disruptive Innovation Knowledge Safari".
09.00:	09.00:	Stage 2: Brief overview presentation of the projects under assessment.
09.45:	11.45:	Break / Lunch
10.00:	13.00:	Stage 3: *Portfolio Maps:* - Understanding the process: How Disrupt-it builds the portfolio maps – 15 mins. - Understanding the perspectives: Introducing your innovation landscape – 45 mins. - Group discussion on what the maps mean - 45 mins.
11.45:		LUNCH
13.00:	08:00	Stage 4: Developing Resourcing Strategies: An organisational needs-driven activity; choices are for example: - Understanding the DPM process (full groups). - Understanding the implications of the maps for I.A.I. (start full group then breakout). - Building innovation strategies (breakout groups).
	1145	Lunch
15.00	15.00	Stage 5: The future of Innovation Strategy at your organisation - Actions and next steps
16.00	16.00	END

Figure 5-5: The DPM Workshop Process

- *Phase 4: Future Actions – New Visions:*

The final phase is driven very much by the participants of the workshop, only when needed is guidance provided by the facilitator. The objective of this process is to use the richness of the preceding conversations in order to construct new visions and value that will guide future resource allocation.

Figure 5-7: Edna Pasher, one of Case B's long-term collaborators discusses the impact of not pursuing disruptive innovation

It is common in this phase for the management team to address the disruptive innovation rejection strategies that have been employed in the past (Figure 5-7). Furthermore, senior strategists will generate new intended futures by physically drawing them on the portfolio maps and gaining agreement from the group.

This is a valuable group experience for the reasons presented in the proceeding section.

The knowledge safari tool:

Objectives

The objectives of the "DI Knowledge Safari" are:

- To distil a large amount of theory and information on DI to the participants of a workshop in a rapid, highly digestible fashion by stimulating the visual, auditory, touch and movement senses (it has been shown that humans learn faster and more effectively when more of their senses are stimulated by the material presented).

- To provide the participants of a DI workshop with a journey through the topic of DI, which provides a holistic view of the content at all times to enable interrelations to be made between the subtopics.

- To ensure the participant's understanding of DI by invoking discussion and debate about the relevance of the content to the participants involved.

Resources Required

The resources required to complete the DI Knowledge Safari are:

1) Two facilitators trained in theory of DI and the use of the DI Knowledge Safari technique.

2) The seven large scale DI graphical templates, or "knowledge posters" described below (figure 3-1 to 3-7).

3) Post-it notes and marker pens to capture the comments and insights of the participants - the participants should be encouraged to make notes of their thoughts and to place them onto the respective graphical template to be discussed at the end of the session.

4) Physical artefacts that were, are or could be disruptive innovations.

The DI Knowledge Safari is usually completed with 8-12 people, when presenting to larger groups it is difficult to ask everyone to move around the 'safari' with the facilitators, therefore, item three may be dropped for a discussion. Item 4 is optional as artefacts are a great way of bringing a subject to life, but they are also a great way to distract people from the content of the presentation and the discussion.

The Process

Facilitators using the DI Knowledge Safari technique attach large scale graphical illustrations, or knowledge posters, of the key findings, theories and insights of DI to the walls of their workshop meeting room. The workshop participants are then quite literally taken on a journey, or a safari, round the knowledge that drapes the walls. The process for the knowledge safari used to raise awareness of DI by the "Opportunity Recognition" and the "Disruptive Portfolio Management" workshops is as follows:

a) The workshop room:

Before the participants enter the workshop room, the graphical templates illustrating the key findings, theories and insights of disruptive innovation are attached to the walls (usually in one long horizontal line in the order that they will be presented). These are intentionally displayed during the opening of the workshop as a way to stimulate the participants from the onset.

b) Introduction:

On beginning the knowledge safari the lead facilitator introduces the "knowledge safari concept" to the participants. They make clear that two presenters will take responsibility to take the participants

on a "safari" through a state of the art understanding of disruptive innovation and that the use of technique will enable a rapid holistic understanding of the concepts that will be introduced.

[N.B. more information on the each of the knowledge posters can be obtained in chapter 1 of this document]

c) The innovation continuum:

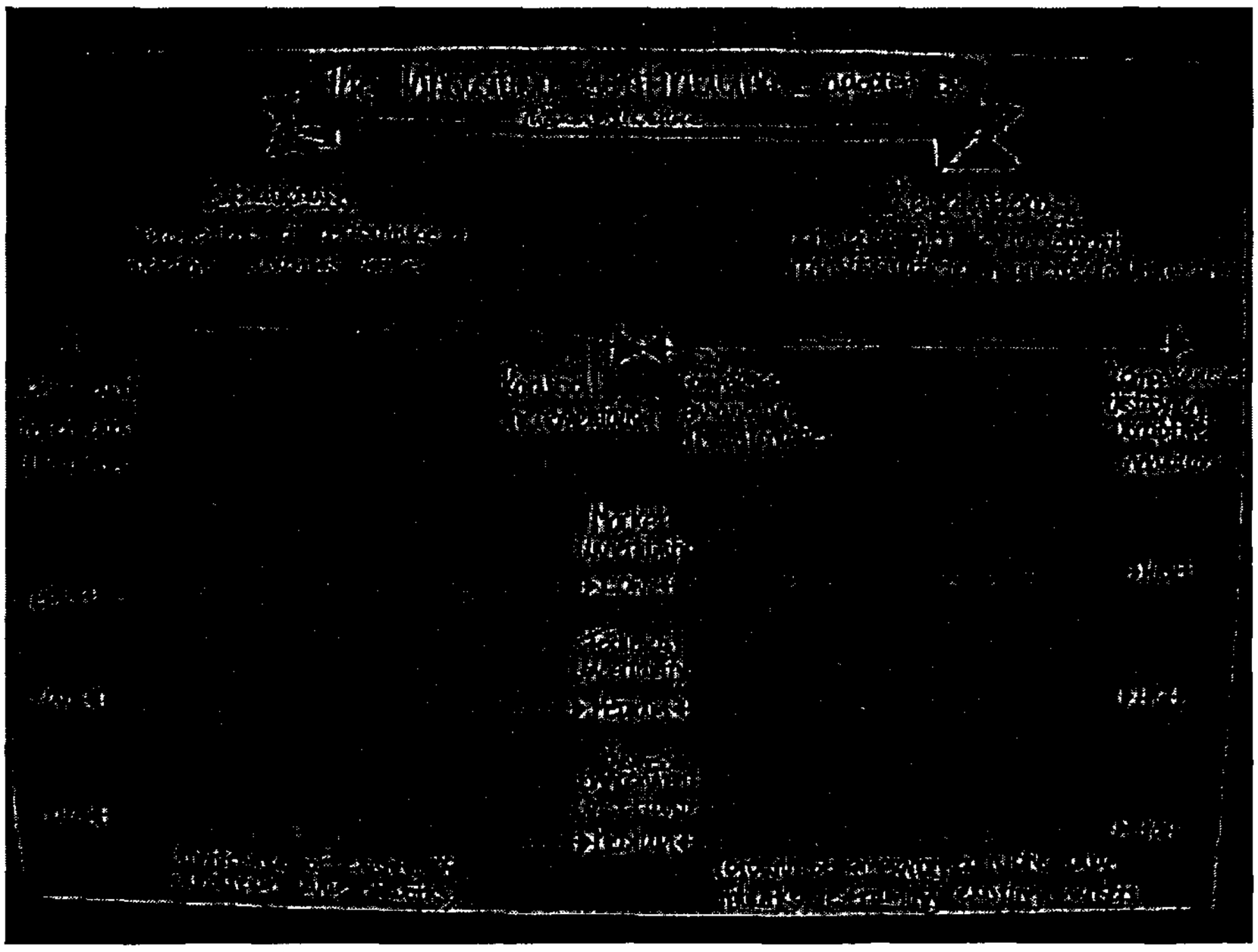


Figure 3-1: The Innovation Continuum (Thomond and Lettice, 2003)

The lead facilitator asks the participants to look at the illustration presented above and during its explanation the following key points: are covered:

- Innovation can be categorised across a continuum from "evolutionary" to "revolutionary".
- Evolutionary innovations range from simple continuous improvements through to radical innovations.
- All evolutionary innovations maintain the existence of existing and mainstream markets.
- Evolutionary innovations improve the performance of products, services and processes in directions that customers and consumers desire, consequently the market uncertainty of evolutionary innovations is low.

- The more radical a leap forward that an evolutionary innovation makes, the more likely that technical and business environment uncertainties will increase.

- Evolutionary innovations cannot guarantee the delivery of long term survival.

- Revolutionary innovations range from competence enhancing discontinuities through to competence destroying disruptive innovations.

- All revolutionary innovations create or grow emerging niche markets (or value networks) that eventually re-frame existing and mainstream markets.

- Revolutionary innovations introduce commercial *and/or* technical performance dimensions that are in conflict with the performance directions desired by customers and consumers, consequently the market uncertainty of revolutionary innovations is high.

- Traditionally, technical and business environment uncertainties range from medium to very high when an organisation introduces a revolutionary innovation.

- Revolutionary innovations offer the otherwise unachievable promise of new wealth creation, however, they are accompanied by high uncertainties and very little is know about how an organisation can foster these benefits as part of a major competitive strategy.

- Disruptive innovations (the extreme of the revolutionary innovations) are the well-springs of new industries; they transform existing markets and thus offer the potential of long term survival.

- Time and again almost all the organisations that have 'died' or been displaced from their industries because of a new paradigm of customer offering could see the disruption coming but did nothing until it was too late. They assess potentially disruptive innovations and frame them as either deficient or as an unlikely threat - much to the managers' regret and the organisation's demise.

- Despite the importance of disruptive innovation, it is an emerging research topic; consequently understanding is traditionally very low. Only a few people have published insights into the subject and no organisations have managed to repeatedly use disruptive strategies.

d) Three types of discontinuity:

Figure 3-2: Three types of discontinuity (Veryzer, 1998)

Using the graphic above the second facilitator explains that the perceived value attributes of a product or service are critical to innovations with potential for disruption. A model developed by Veryzer in 1998 makes the distinction between two dimensions:

- "product capability" - the benefits of products as perceived by customers and users; and
- "technological capability" - the degree to which the product involves expanding capabilities beyond existing organisational boundaries.

- This model uses the following examples to illustrate how organisations can deliver three types of discontinuous innovation and how each type requires a different management approach:

- "Flat Screen TVs" show that an organisation can introduce a radically different technology into a market, creating a discontinuity, yet not offering the consumers significantly more in the way of product capability.

- "Sony Walkman" utilised existing technologies to introduce a discontinuity that significantly improved the benefits of products as perceived by customers and users.

- "Compact disks and disk drives" were responsible for disrupting the traditional vinyl record and mini-computer markets respectively with the introduction of enhanced product and technological capabilities.

e) A model of disruptive innovation – "low-end disruption":

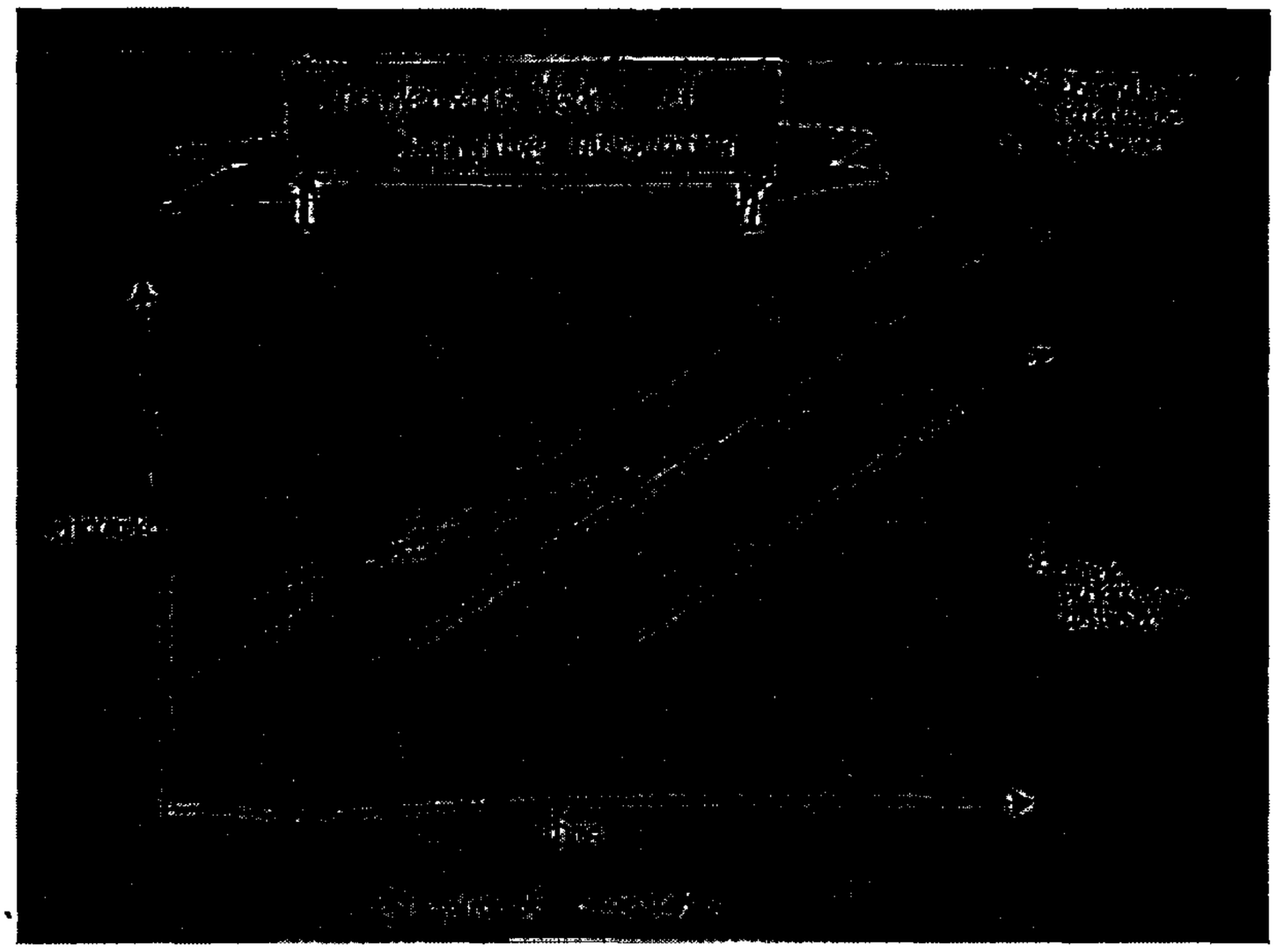


Figure 3-3: Low-end Disruptive Strategies (Christensen, 1997)

The second facilitator introduces the most famous model of disruptive innovation as proposed by Clayton Christensen in 1997. In essence this model introduces the following notion:

- Organisations often over-supply their customers' needs with excess technological functionality (just think about how Microsoft Word does things that you do not need) or services that they do not actually require.

- "Oversupply" leaves a vacuum for other products/services to target the low-end market niches with a simpler offering that can be consumed in more convenient settings.

- By being patient for growth but impatient for profitability the new offering can be gradually improved and allowed to migrate upstream.

- This migration can continue up to the point where it can satisfy the average customer needs of existing mainstream markets and take over as the dominant paradigm of customer offering.

- The organisation following a low-end disruptive strategy must begin with a well defined niche of "over-supplied" low-end customers of an established market and adopt a stance of being "patient for growth but impatient for profitability".

Examples of low-end disruptions include:

- The personal computer's impact upon mini-computers.

- Intel's introduction of Celeron - disrupting its own market but ensuring longer term survival.

- MP3's with their lower quality sound playback are disrupting CD's with high quality digital performance.

In academic terms Christensen's model illustrates how established firms' decisions to ignore new customer offering that do not appear to address their customers' needs become fatal when two paradigmatic trajectories of progress interact – thus the term "disruptive innovation" is introduced to explain the impact of this interaction:

- As the performance demanded by an organisations customer's increases over time so does the performance provided within a technological paradigm.

- Quite often the performance improvement provided has a different trajectory to the trajectory of performance improvement demanded by customers.

- When the trajectory slopes differ, and performance provided exceeds performance demanded, new technologies that were only performance-competitive in remote value networks may migrate into established markets.

- This provides innovators with a vehicle to new customers, who would have previously viewed the innovation as substandard;

- Enabling them to offer established mainstream markets a new set of performance attributes that are now more relevant than the current paradigm.

f) A model of disruptive innovation – "*new-market disruption*":

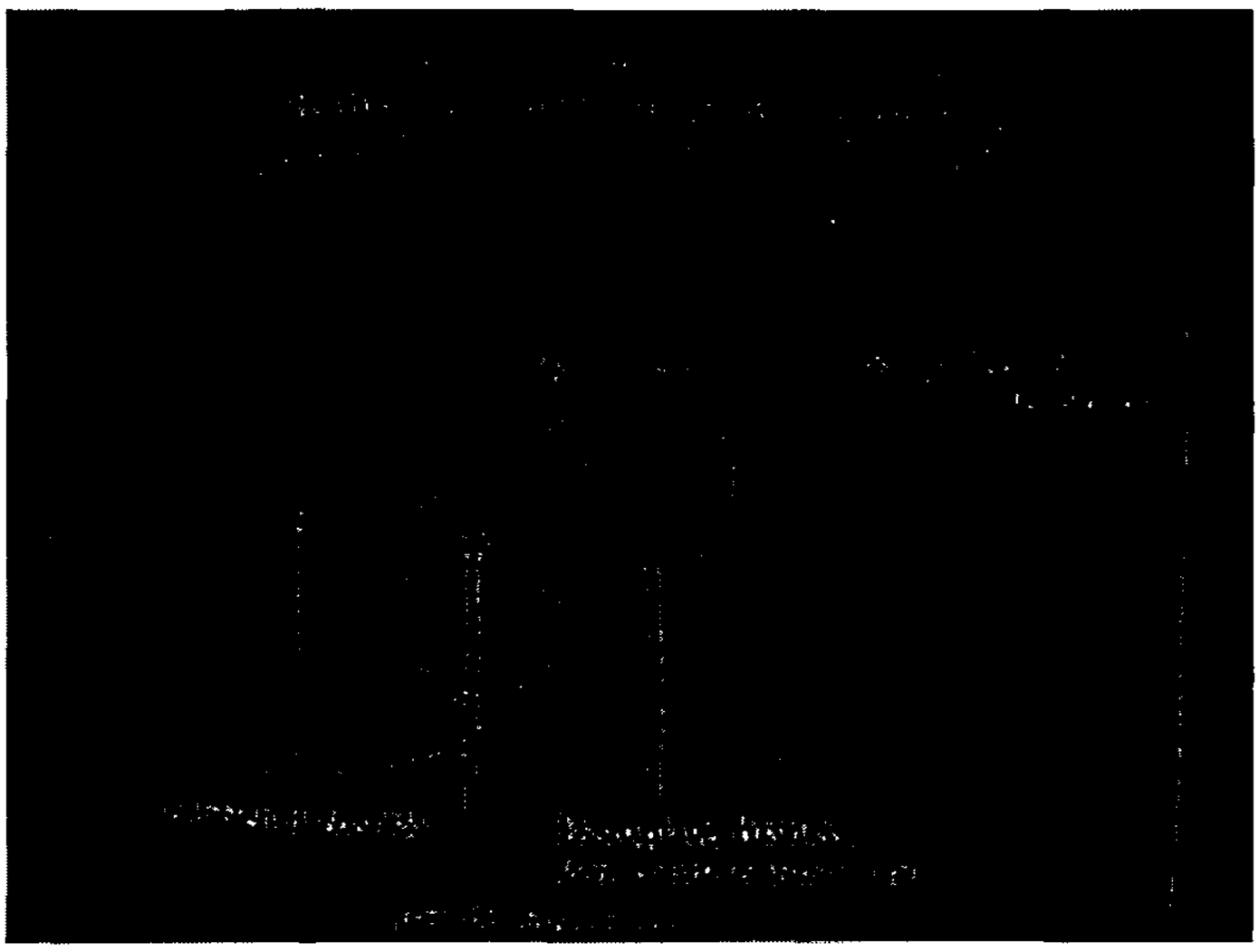


Figure 3-4: New Market Disruptive Strategies (Gilbert, 1997)

The lead facilitator explains that an author called Gilbert (2001 and 2003) refers 'new-market' disruptive strategies'; these occur when:

- 'Non-consumers' are offered a simple, convenient product/service that allows them to do things that they would not have other wise been able to do.

- The growth of the new market is ignored by established companies as it is considered too small and "are not up to snuff on the performance criteria that existing companies talk about".

- Much like the 'low-end' disruptions described above, as the offerings improve 'new-market disruptors' begin to attract customers away from established markets

- Finally by the time incumbents begin to notice the defection, its too late, the innovations permanently reshape and disrupt existing markets.

- In summary, the organisation following a new-market disruptive strategy must begin with a well defined niche of "non-consumers" and adopt a stance of being "patient for growth but impatient for profitability".

g) Why organisations often fail to capitalise on disruptive innovation – "crossing the chasm":

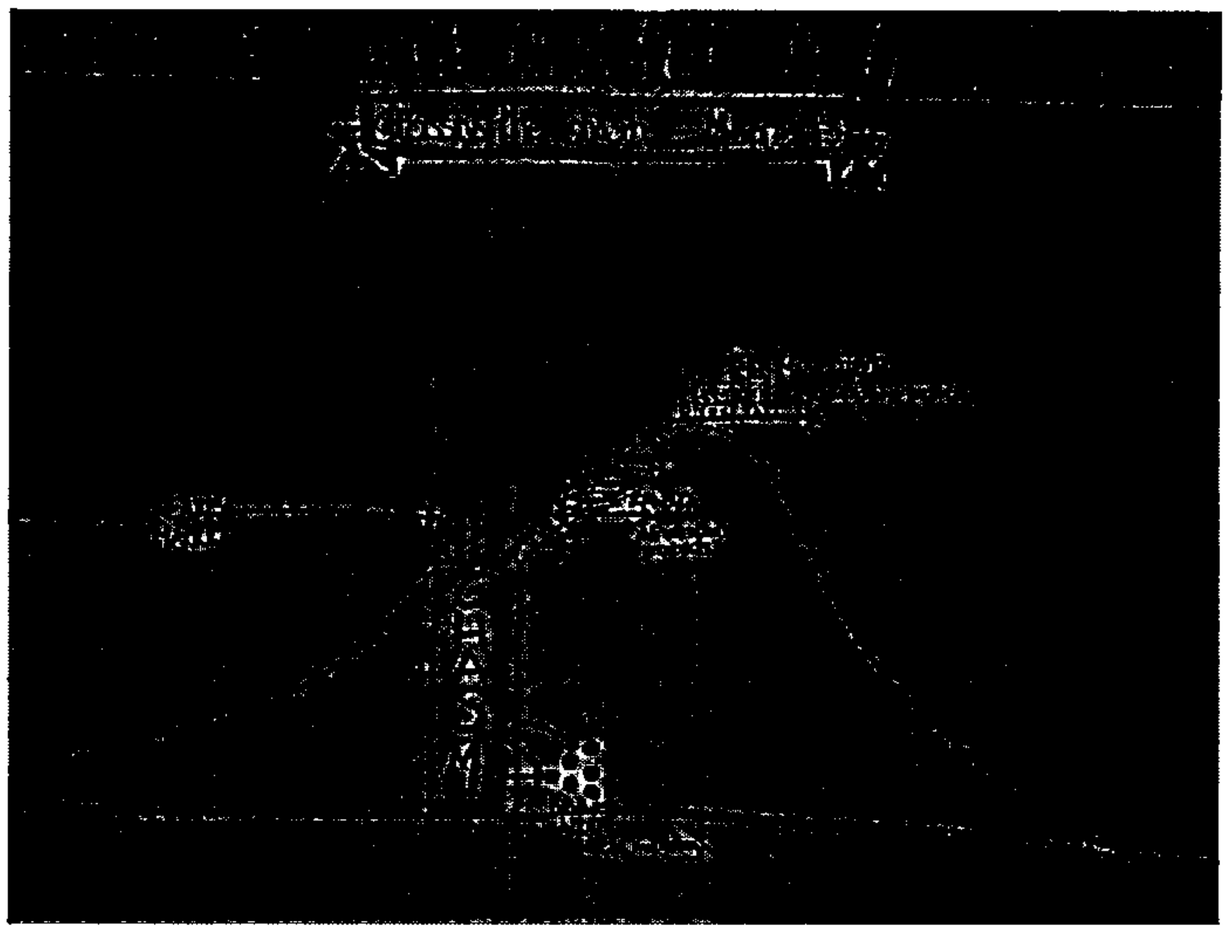


Figure 3-5: Crossing the Chasm (Moore, 1995)

The second facilitator explains that if an organisation manages to foster a potentially disruptive idea, there are problems to overcome to get it adopted by the mass market:

- A model proposed by Moore (1995) addresses the huge difficulties faced by companies trying to 'cross the chasm' from early market acceptance to gain the support of the 'early majority'.

- The key message from the model is that the market for a potentially disruptive innovation can be segmented.

- The 'early market' niche may be enthusiastic about the new offering; however this segment accounts for less than 13% of a market's population – thus an innovation with the potential for disruption must cross the chasm into the mainstream of an existing market.

- True market disruption will not therefore be successfully exploited if the organisation does not find a niche market with a "compelling reason to buy" within the 'early majority' of the population.

- It is from this customer base that other niches can be sought and conquered with the appropriate "Bowling Ally" (niche marketing) strategy and disruption can truly be realised.

- The difference between the "visionaries" in the early market and the "pragmatists" in the early majority are introduced to illustrate why potentially disruptive innovations often fall into the chasm of failed disruption.

h) Why organisations often fail to capitalise on disruptive innovation – "organisational structures":

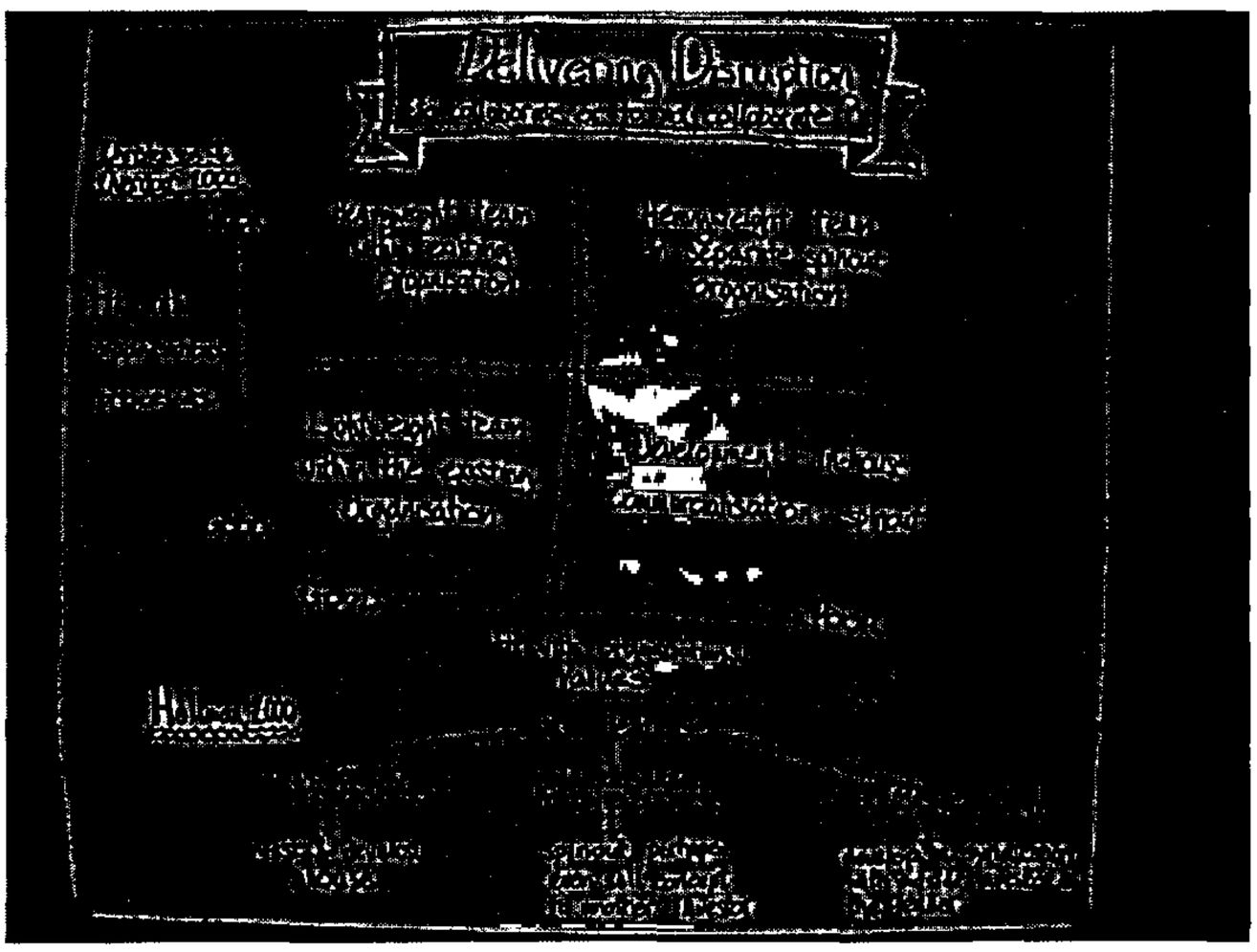


Figure 3-6: When to spin out? (Christensen and Overdorf, 2000)

The lead facilitator explains that inappropriate organisational structures are often the reason why businesses fail to capitalise on disruptive innovation. The first illustration on the graphic above shows a two-by-two matrix which can be used to assess a new innovative concept and to provide advice on which organisational structures will best suit exploitation. The horizontal ('x') axis is used to assess a concepts degree of fit with an organisations values (its strategy, beliefs and culture) measured from good to poor, whereas the vertical ('y') axis assesses whether the concept will fit with an organisations' processes (its capabilities and internal structures).

- If a new concept has a good fit with organisational values and processes then a lightweight team within the existing organisation is best suited to for development and exploitation.

- If a new concept has a good fit with organisational values but internal processes, capabilities and structures are not well-matched, then a heavyweight team within the existing organisation is in the best position for development and exploitation.

- If a new concept has a good fit with organisational processes but it clashes with its values, then the organisation should develop the concept in-house but create a separate spin-out organisation for exploitation.

- If however, a new concept has a poor fit with both organisational processes and values yet has the potential to generate new net wealth, the organisation should provide some seed funding for a separate heavyweight spin-out operation.

i) The characteristics of disruptive innovation:

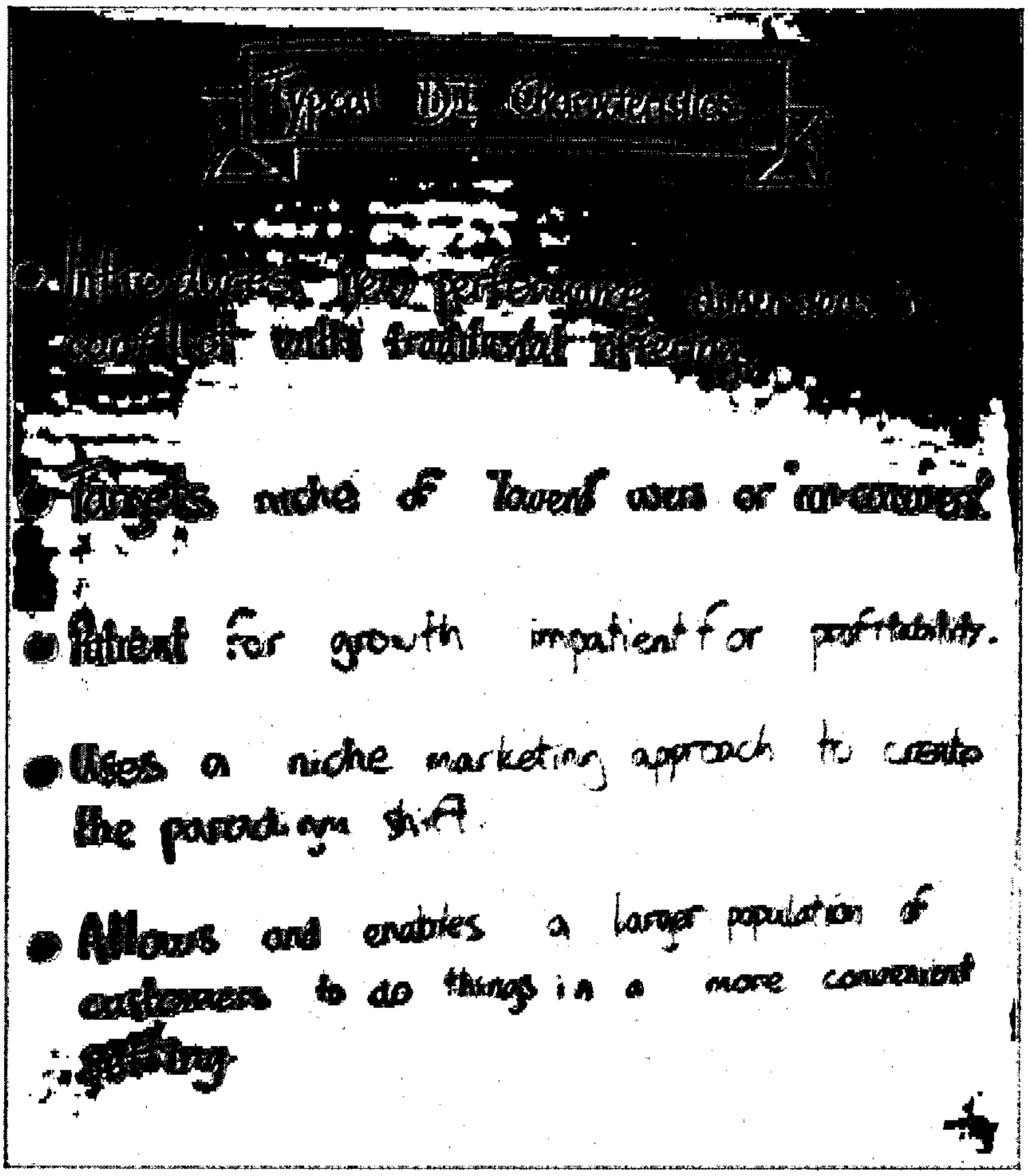


Figure 3-7: Characteristics of DI (adapted from Thomond and Lettice 2003)

Finally the lead facilitator presents a summary of the typical characteristics of a disruptive innovation, as illustrated above.

j) Closing the DI Knowledge Safari:

When reaching the end of the DI Knowledge Safari, it has been found that a final tailored graphical template should be used to introduce the next element of the workshop. This could be introducing a method to conduct a structured brainstorm, or it could be to introduce a new topic.

For example, the DPM methodology uses the DI Knowledge Safari to kick-start the workshop element of the offering. This allows the facilitators to bring the participants to up to the same level of understanding of the terminology used in the tool. At the end of the knowledge safari the the facilitators use a final template introducing the key objectives of Portfolio Management techniques. This allows the participants to see connections with the 'new' topic and DI.

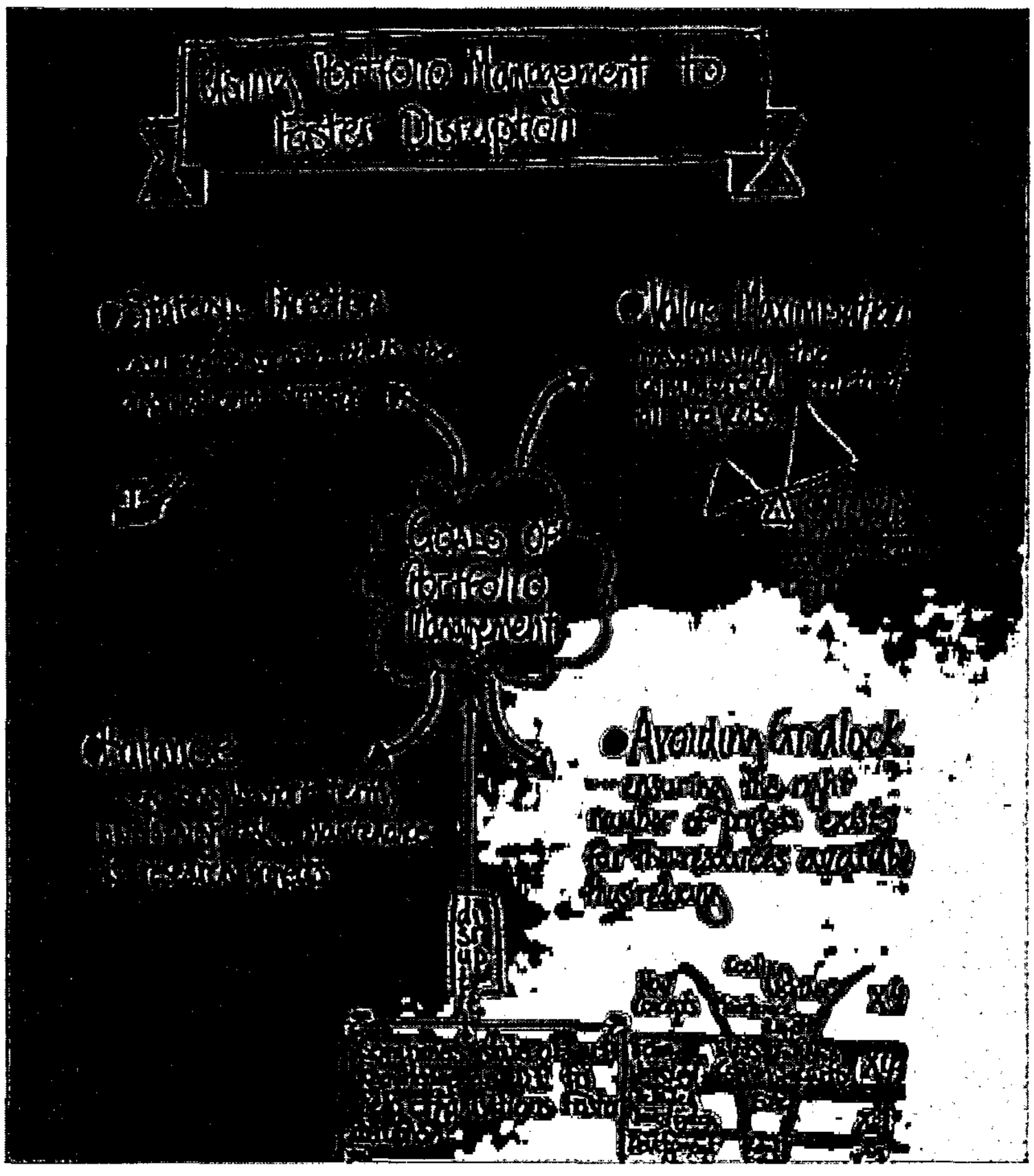


Figure 3-8: Goals of Portfolio Management (adapted from Cooper, Edgett and Klienschmidt, 2001)

Appendix 6: Aggregated results of the initial feedback questionnaires following the DPM interventions

Aggregated results at Case A:

The overall workshop was considered:

How beneficial has the DPM process been to your organisation?	1	2	3	4	5	6
1 = no benefit to 6 = highly beneficial						☺

To what extent has the DPM process contributed to you professionally?	1	2	3	4	5	6
1 = no benefit to 6 = highly beneficial						☺

How useful were the large scale graphic templates to the DPM workshop process?	1	2	3	4	5	6
1 = not effective to 6 = highly effective						☺

A knowledge safari was used to explain disruptive innovation:

Objectives of Knowledge Safari	Not met at all	Hardly met	Partially met	Half met	Mostly met	Completely met
To explain the concept of disruptive innovation.					☺	
To make the concept of disruptive innovation applicable to Case A				😐		
To explain the use of portfolio management techniques.						☺
To explain how portfolio management techniques can be used to foster disruptive innovation.					☺	

The following questions relate to the Dimensions Ranking Checklist process:

Objectives of assessing the innovation initiatives and showing how the DPM tool builds the portfolio maps.	Not met at all	Hardly met	Partially met	Half met	Mostly met	Completely met
To demonstrate that a comprehensive methodology has been developed to assess the projects and to produce the portfolio maps						☺
To show that the DRC methodology can be implemented easily as homework		☹				
To show that the methodology can be manipulated to suit any organisation's needs.				☺		

The following questions relate to the workshop process:

Objectives of introducing and discussing the innovation landscape of Case A	Not met at all	Hardly met	Partially met	Half met	Mostly met	Completely met
To introduce and explain the portfolio maps used in the workshop.						☺
To introduce and familiarize the group with Case A 's "innovation landscape".						☺
To explain the general implications of the maps generated from Case A 's project data.					☺	
To allow the participants to understand the implications of their narrow project selection and the team's current resource allocation strategy						☺

Objectives of initiating discussion on the development of new resource allocation approaches and Case A 's future "Innovation Strategy".	Not met at all	Hardly met	Partially met	Half met	Mostly met	Completely met
To probe the portfolio views for the implications of individual project positioning and individual project funding decisions.				☺		

Objectives of initiating discussion on the development of new resource allocation approaches and Case A 's future "Innovation Strategy".	Not met at all	Hardly met	Partially met	Half met	Mostly met	Completely met
To probe each of the important portfolio views for the deeper implications of Case A 's current innovation strategy and resourcing approach.					☺	
To develop an understanding of how the senior management team's actions influence the innovation efforts of Case A .						☺
To develop new visions and to understand how the DPM Tool can be used to protect resources for radical and potentially disruptive projects in the future				😐		
To consider the feasibility of current priority projects whilst considering the entire portfolio view.						☺
To suggest improvements to Case A 's innovation strategy.					☺	
To understand how the DPM tool can be used to support a broader selection of projects and to enable more informed strategically aligned resource allocation decisions				😐		

Aggregated results at Case B:

the specific objectives of the workshop were considered:

A knowledge safari was used to explain disruptive innovation:

Objectives of Knowledge Safari	Not met at all	Hardly met	Partially met	Half met	Mostly met	Completely met
To explain the concept of disruptive innovation.					☺	
To make the concept of disruptive innovation applicable to CASE B					☺	
To explain the use of portfolio management techniques.						☺
To explain how portfolio management techniques can be used to foster disruptive innovation.					☺	

The following questions relate to the Dimensions Ranking Checklist process:

Objectives of assessing the innovation initiatives and showing how the DPM tool builds the portfolio maps.	Not met at all	Hardly met	Partially met	Half met	Mostly met	Completely met
To demonstrate that a comprehensive methodology has been developed to assess the projects and to produce the portfolio maps						☺
To show that the DRC methodology can be implemented easily as homework						☺
To show that the methodology can be manipulated to suit any organisation's needs.					☺	

The following questions relate to the workshop process:

Objectives of introducing and discussing the innovation landscape of Case B .	Not met at all	Hardly met	Partially met	Half met	Mostly met	Completely met
To introduce and explain the portfolio maps used in the workshop.						☺
To introduce and familiarize the group with Case B 's "innovation landscape".						☺
To explain the general implications of the maps generated from CASE B 's project data.					😐	
To allow the participants to understand the implications of their narrow project selection and the team's current resource allocation strategy						☺

Objectives of initiating discussion on the development of new resource allocation approaches and Case B 's future "Innovation Strategy".	Not met at all	Hardly met	Partially met	Half met	Mostly met	Completely met
To probe the portfolio views for the implications of individual project positioning and individual project funding decisions.			☺			

Objectives of initiating discussion on the development of new resource allocation approaches and Case B 's future "Innovation Strategy".	Not met at all	Hardly met	Partially met	Half met	Mostly met	Completely met
To probe each of the important portfolio views for the deeper implications of Case B 's current resource allocation approach.						☺
To develop an understanding of how the senior management team's actions influence the innovation efforts of Case B .						☺
To develop a new strategic innovation vision for the future.						☺
to understand how the DPM Tool can be used to protect resources for radical and potentially disruptive projects in the future				😐		
To consider the feasibility of current priority projects whilst considering the entire portfolio view.			😐			
To suggest improvements to Case B 's innovation strategy.						☺
To understand how the DPM tool can be used to support a broader selection of projects and to enable more informed strategically aligned resource allocation decisions					☺	

Appendix 7: Assessing the shortfalls of the DPM intervention

Weaknesses of the individual elements of the DPM process:

In order to assess the shortfall of the DPM intervention process an evaluation was conducted regarding some of the specific elements of the methodology

☐ *The dimensions ranking checklists (DRCs) - complexity of questions:*

The DRC questions were reported to be too complex in terminology because of high academic content. For example, Case B sent several emails requesting clarification of question objectives and of terminology. Although all the participants stated that the DRC process was well designed and thorough, the complexity reduced their confidence that the process was easy to adopt.

☐ *The DRCs - length of process:*

It was reported that the DRCs took too long to complete. Although eventually it was agreed that the benefits of the lengthy analysis and discussion outweighed the early cost of time consumption, it was clear that industrial collaborators with less commitment to the research may not have been as willing to initially undertake such an extensive process. In particular, it was suggested that a simpler DRC process should be specifically designed for SMEs.

☐ *The DRCs - understanding the maturity of prevailing project assessment methods:*

Following analysis of the feedback data, regarding the completion of the DRCs, it was apparent that more attention should have been given to both cases prevailing project management and assessment mechanisms. In particular, the pre-intervention meetings and teleconferences would have benefited from more discussion regarding the maturity of the collaborators' project assessment methods and project information levels. This would have helped to govern how much time should be allocated to the "homework project assessment phase" – the completion of the DRCs. For example, it is believed that Case B's process maturity could be considered to be of an average or medium level. For this reason, they reported that they would have benefited from a one-day facilitated DRC exercise. Alternatively, an organisation with mature well rehearsed processes could complete the DRC assessments as a one-day, participant-driven, 'homework' exercise. Companies such as Case A with low process maturity would benefit from a DRC exercise spread over an agreed period of time, whereby the client (and if need be the facilitator) can collect and disseminate additional information to help complete the process.

☐ *The DRCs - The benefits of externally facilitated individual project assessment:*

Case A participants reported that the DRCs were too complex to be completed as 'homework'; this increased Case A's dependence upon the author, as an external facilitator, to help the DPM participants to complete the project assessments. Rather than causing a problem, this proved to be a fortuitous situation. It emerged that Case A benefited from the facilitated individual project analysis as much as it did the facilitated holistic portfolio analysis. The DRCs raised many useful questions that the team had not previously asked of itself, having a facilitator present assisted in the capture of a deeper organisational understanding of each initiative and avoided rushed, unconsidered answers. This generated well considered project data, which increased confidence later in the process when the portfolio maps revealed invaluable insights that were previously unachievable. More benefit could have been delivered if more time was allocated to this exercise.

☐ *The DRCs – complications:*

The main complications that arose from the DRC process did so because the practitioners from both cases were asked questions about individual projects that had never previously been considered in depth. This meant that some information could not be as forthcoming as desired; therefore, raising issues regarding the reliability of some of the answers. Consequently, the participants reported it would have proved useful to spend more time on project assessment, especially when mining for data on size, growth, variances and expected penetrations of markets.

☐ *Opening the DPM Workshop with the 'knowledge safari' knowledge transfer exercise:*

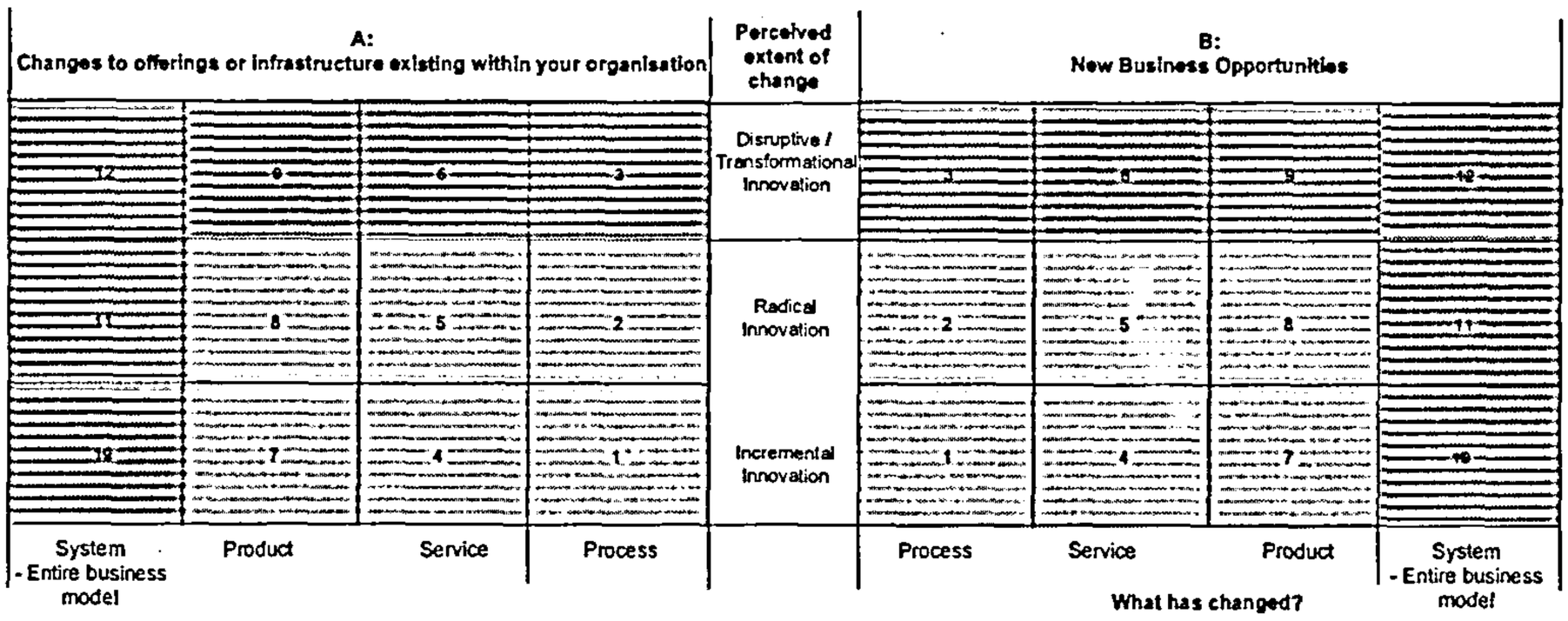
The participants of Case A struggled to relate to specific elements of the disruptive innovation knowledge safari as the content did not have a strong focus upon SMEs. It was reported that more stories, experiences and case studies from the SME arena would have proved useful. Likewise, participants from Case B stated that the knowledge safari helped them to understand some of the theory of disruptive innovation; but it was not until they began to discuss the implications of their constrained portfolio of innovation activity that the theory came to life. This suggests that specific examples of disruptive innovation must be presented during the knowledge safari; these should relate to the participating organisation and its industry. The feedback suggests that this would bring the theory to life in a context better understood by the participants – although it would require prior investigative work.

Furthermore some of the terminology used was reported to be 'too academic'.

☐ *The number of portfolio maps and the complexity of the intervention:*

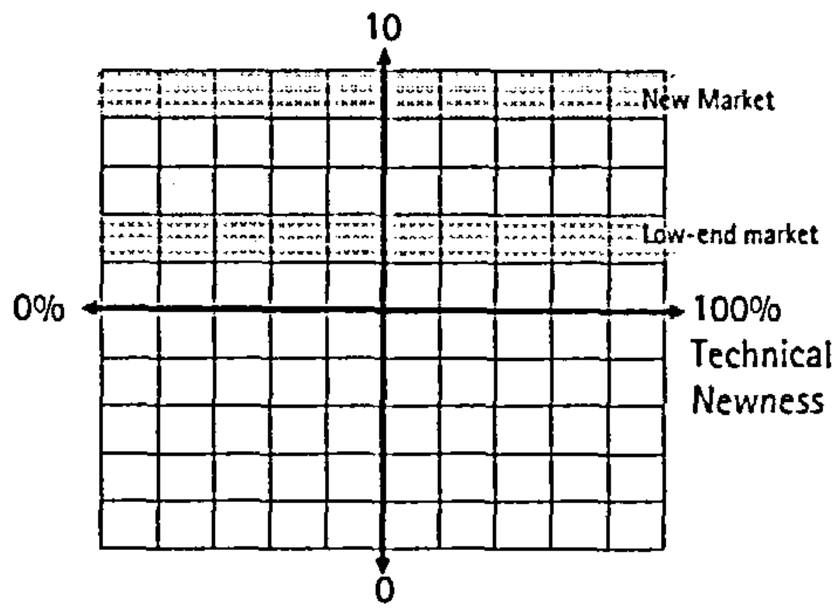
It became clear when building the portfolio maps that the team at Case A would not be able to absorb or utilise all the information from all 7 possible maps. A decision was made to not burden the team with an over supply of information. Instead, Case A's Director General helped select 4 maps to facilitate the discussion and analysis - two of the key traditional maps and two maps that incorporate knowledge on disruptive innovation (Figure 5-13). Interestingly, a similar situation arose at Case B and these same four maps emerged as the most useful in the one-day intervention - although it was noted that with more time the other maps may have played a larger role in the discussions. The concentration upon these four maps also nullified the use of the section within the DRCs on project management assessment. Therefore, it was concluded that the design of the intervention was perhaps too complex. The pre-intervention discussions could have been used to limit the number of maps, and to cut out the project management section of the DRCs. This would have reduced the data collection burden in the project assessment phase, thus making the DRCs easier to complete.

Map 1

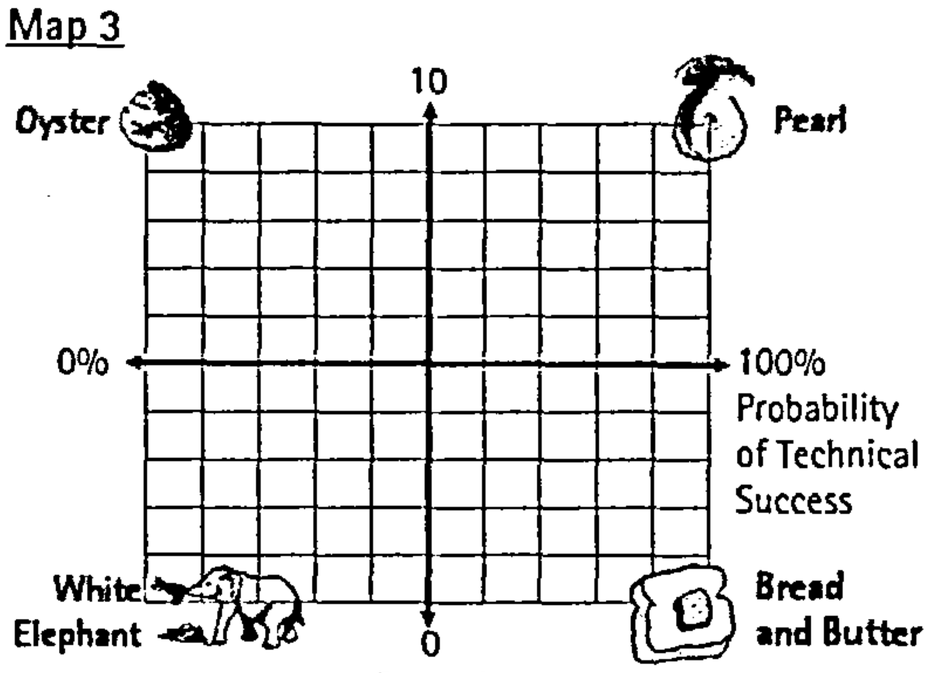


The references A1-A12 and B1-B12 refer to the taxonomy of innovation identified and used by the DPM tool

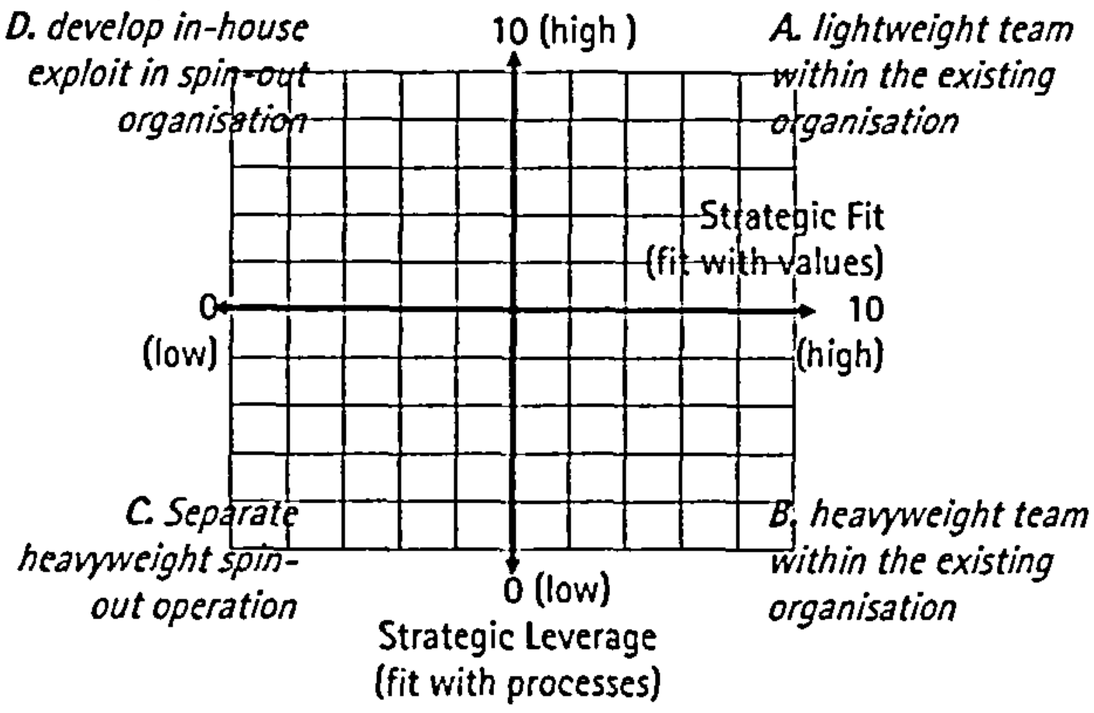
Map 2



Map 3



Map 4



Key:

Map 1 = The 'innovation playing field' – the global impact of innovation activity.

Map 2 = Market Newness vs. Technical Newness.

Map 3 = Reward vs. Probability of technical success.

Map 4 = Strategic Fit vs. Strategic Leverage.

Figure 7-1: The four most useful and popular portfolio maps.

☐ *Preparing for emotional reactions:*

French and Bell (1990) note that during organisational interventions emotional reactions may occasionally emerge from participants. Amis, Slack and Hinnings (2004) found that whilst it is

important to tackle decision making routines to create a transformation of organisational behaviour, these areas are "also likely to be the most contentious parts of an organization to alter and thus changes to them precipitate most resistance" (p35). Despite these warnings this investigation did pay not enough credence to the potential for emotional reactions. The author should have sought more advice upon how workshop participants react, both rationally and emotionally, when their traditional perspectives are challenged. One of the participants from Case A stated "... if you could have warned us at the beginning of the workshop that today might get uncomfortable, things might not have got so heated..." [A-Head of Sales-IS-DPM-3245]. Further attempts to implement this intervention would follow this advice at the onset of the DPM workshop. It is believed that overt acknowledgement of the likeliness for emotional reactions would allow the participants and the facilitator to diffuse emotional situations if they later emerged.

☐ *Implementing the DPM intervention during organisational decline:*

The DPM process provided noted benefits to Case A even whilst it was suffering organisational decline. However, comparisons of the benefits delivered between Cases A and B reveal that a return on an investment of management time into such an intervention is more difficult to prove for a struggling firm. This experience suggests that the DPM approach may be more suited to organisations in less turbulent environments or in periods of growth, as these businesses are in a stronger position to provide the nurturing ecologies for disruptive innovation. Extant literature shows that disruptive innovations require "longer run-ways before a steep accent is possible" (Christensen and Raynor 2004:291. Thus, it would appear that organisations which are not undergoing periods of decline will be better positioned to offer these longer, sheltered run-ways.

☐ *The effect of facing "unusual organisational objectives":*

It was concluded that unusual organisational objectives, such as Case B's desire to create more jobs for Israeli citizens, should have been surfaced earlier, preferably in the pre-intervention process. This would have provided the author, as the facilitator, with more time to assess whether the pursuit of disruptive innovation can be linked to these unforeseen intentions.

☐ *Maintaining flexibility:*

When critical issues emerged, during both interventions, it became clear that the participants were not keen to complete all of the prearranged tasks. .For example, during the intervention in Case B, the objective of discussing the implications of how the individual projects were positioned was dropped in favour of an emergent dominant objective: 'to create a new focus for the future'. The

flexibility of the workshop allowed the DPM process to respond to emergent priorities; this was rated by all participants as an important factor in the DPM's perceived success. Bell and French (1990) note that social scientists must ensure that influential participants do not dominate or commandeer an intervention process. Therefore, decisions regarding responsiveness and flexibility were not taken lightly, as researchers must attempt to they stay faithful to the intervention in hand, for the results to be accurately assessed.

☐ *The sacrifice of industrial requirements for the benefit of the research:*

In the final design phases of the DPM intervention, the collaborating practitioners stated that they wanted to the DPM workshop to deliver two additional objectives:

- an understanding of how the DPM approach could be used to protect resources for disruptive innovations, and

- an understanding of how the DPM approach could be used on an on-going basis to deliver new strategic action.

However, these objectives were only partially met, as the flexibility of the intervention allowed the author, as facilitator, to focus each group's attention on the emergent 'burning issue' of better understanding the behaviour that constrains innovation activity. This decision supported the aims of this thesis, but not the stated requirements of the collaborating businesses. Despite this concern the most senior participants later stated that the focus upon behaviours (and not just financial mechanisms) that prevent the allocation of resources to potentially disruptive innovations was insightful and highly useful to their aims.

☐ *More time was needed:*

The flexibility of the workshop allowed the groups in both interventions to focus their attention on the 'burning issues', as such it was concluded that more time was needed to pursue the deeper benefits of the DPM approach. Both case study sites announced their interest in future implementations of the DPM methodology, both also stating that it should co-incide with their planning cycle and that it should be allocated more time that was available in the research.

Issues that the DPM intervention neglected

The key issues that were overlooked or neglected by the DPM intervention process are discussed in detail in section 6.5 (recommendations for future research), however, these can be summarised as:

a) The need for more focus on the relationship between the susceptibility of cognitive dissonance and the breadth of technological activity.

b) The top management teams of cases A and B were, by there very nature, diverse cross function groups of people. The issue of the diversity of these 'resource allocation committees' should have been considered in more depth.

c) Both intervention sites were stakeholders in a number of collaborative innovation efforts. A multi-stakeholder perspective on the portfolio maps may have generated insights to better understand the role and purpose of each organisations within these value networks.

d) A longitudinal approach to the DPM intervention may have shed light on how mental models evolve and how they can be challenged and changed. This may have provided more insights into how organisations adopt new concepts to survive in an increasingly discontinuous world.

e) The DPM intervention used a portfolio management approach to deliver holistic thinking. An empirical consideration of other tools that that facilitate holistic thinking (e.g. 'Learning Maps', 'Visual Metaphor Elicitation' (Young, 2003) and Technology Roadmapping (Phaal et al., 2004) etc.) could deliver a better understand of the advantages and disadvantages of such tools. This would allow future management interventions to enhance the benefits of holistic thinking to better overcome the dilemmas faced in the pursuit of disruptive innovation.

Appendix 8: A method to evaluate the mode 2 approach

An evaluation of the four features that typify the Mode 2:

According to Stewart et al. (2000) there are four features that typify the Mode 2 approach to research. These, or similar features, are commonly reference by other authors in the field of research design when discussing 'mode 2' or academic-industrial collaborative approaches to management inquiries. Therefore, if the current research was implemented correctly and appropriately we would expect to see that these features have played an integral part in the research.

Feature 1: The research problem must be framed in the context of application.

One of the critical gaps in knowledge, identified in Chapters 1 and 2 of this thesis, is the lack of pragmatic industrial advice for management practitioners wanting to pursue disruptive innovation as part of a major competitive strategy. This notion was held at the heart of the current inquiry.

The research problem was: 'how can senior practitioners understand and foster disruptive innovation as part of a major competitive strategy?'

The 17 core members of the multi-case, multi-level research group were asked the following question:

Was this research problem framed with an academic or industrial focus?

Result:

10 answered industrial.

7 answered both.

Throughout the research programme, academic theory and findings from data analysis were constantly discussed in the context of how they apply in the real-world industrial settings of the four industrial collaborators. This was mostly conducted in workshop settings. The commitment of the research participants and their open and honest temperament, allowed the researcher to probe these areas in much more depth than could have been achieved without the collaborative nature of the research (e.g. within the limited confines of a short interview setting).

Feature 2: A heterogeneous group of both academics and practitioners should be engaged in the investigation, using a trans-disciplinary approach.

In total 127 industrialists took part in this investigation. Four different case study sites from four different countries provided a total 17 core members of the collaborative research group. In addition a further 103 employees from the four case study organisations participated in one-off or infrequent data collection workshops and questionnaires, there were also 7 expert industrial interviewees. The organisational functions that were performed by the participants could be divided into 9 clusters and the organisational roles could be divided into 8 clusters (Table 10-7). Furthermore, 8 expert academics (4 from Britain and 4 from Germany) were consulted either once or intermittently throughout the inquiry.

Organisational Function	Organisational Role
Finance	CEO
Marketing	Director / Divisional Head
Purchasing	Senior Manager
R&D/Design	Manager
Manufacturing/Operations	Senior Consultant
Sales	Consultant
Human resources	General Employee
Legal	Mixed Role
Cross Functional	

Table 10-6:The organisational functions and roles of the participants involved in this research.

Therefore, it was concluded that a truly heterogeneous group of both academics and practitioners were engaged in this investigation, using a trans-disciplinary approach

Feature 3: The group should have a socially-distributed research capability.

The collaborative nature of this investigation was very much driven by the author. Despite the author taking responsibility for driving the research programme, he also ensured that it was responding to the industrialists needs. Furthermore, one of the key reasons for the success of the investigation was the fact that the industrial members of the research group would commit to

taking actions from the meetings. These may have been to arrange workshops or interviews, but they also included conducting data collection and group discussion sessions within their own organisations. Therefore, the research capability and the responsibility for the research programme became socially-distributed.

> *The research problem was: 'how can senior practitioners understand and foster disruptive innovation as part of a major competitive strategy?'*
>
> *The 17 core members of the multi-case, multi-level research group were asked the following question:*
>
> *Did you feel personal responsibility for the outcome of this investigation?*
>
> *Result:*
>
> *17 answered YES.*
>
> *0 answered NO.*

Feature 4: Theory-building and application should be combined in the co-production of new knowledge.

The conceptual framework delivered in the first wave of this research was grounded in data from the case studies, thus, theory building was conducted in the context of application. In the second wave of this research the conceptual framework was applied to reassess the case study sites. This resulted in the co-production of new knowledge; the top four barriers to the pursuit of potentially disruptive innovations had been identified. However, nowhere else could this final feature of mode 2 collaborative research be more clearly seen than in the third and final wave of this research. Theory building led to the development of the DPM intervention, this was applied in the industrial settings of cases A and B, and the resultant effect was the co-production of new knowledge on the deep set root causes of inappropriate resource allocation routines and how they prevent organisations from pursuing potentially disruptive innovations.

In sum, it is believed that this research has been based upon the correct delivery of the mode 2 collaborative approach.

An evaluation of the quality of the inter-organisational collaboration:

A special interest group on 'inter-organisational relations' was established by the British Academy of Management, in order to assist in shaping the research agenda of the coming years. Gray (2004) recently attended this forum and presented a significant review of extant literature regarding inter-organisational collaboration. In summarising the complementarities and tensions in the context of collaboration, she offered four theoretical propositions, of what could be thought of as idealistic collaboration measures. Many of the members of this group have displayed support for these propositions and her work continues. In the absence of any other such comprehensive yardstick the current investigation will use Gray's propositions to assess the quality of the collaborative approach that was adopted.

Idealistic Collaboration Proposition 1: An increase in social capital among stakeholders leads to a greater likelihood of improved future collaboration.

Putman (1993) defines social capital as features of social organisations, such as trust, norms, and networks, which facilitate co-operative action for mutual benefit. At the onset of this research significant attention was given to team and trust building. Furthermore a focus was kept upon social activities at all group meetings - in fact social time proved to be as fruitful for gaining insights into the case study organisations as formal work time. Norms emerged that were supportive to open, frank and honest discussion. And each of the core group members used their extensive intra and inter organisational networks to bring extra richness to the data collection.

> *In July 2004, at the final meeting of the research group, 10 of the 17 core members reported that this investigation had been the most fun and the most fruitful research programme that they had been involved in for many a year.*

It was observed that as trust and openness increased so did the quality of the collaboration and the quality and depth of the data collection and data analysis exercises.

> *Also at the final meeting of the research group, 11 of the 17 core members expressed their interest in pursuing the initiation of another working group to extend the research programme.*

Idealistic Collaboration Proposition 2: Successful collaborations need to address the tensions between need for shared meaning and diversity.

The research group, as expressed earlier, was highly diverse. This led to many circumstances where tensions arose. However, these were minimised by two factors:

- The rapid pursuit of construct equivalence (Welkenhuysen-Gybels and Van de Vijver, 2001), which generated a common language and reduced frustrations surrounding translation or misunderstanding of terminology.

- The embracing of diversity ensuring a "no ideas are bad philosophy" and by allowing individuals to develop and present their own thoughts. Furthermore, people were encouraged to conduct rapid experiments with new ideas and to report back to the group.

Moreover, the high levels of social capital drove the group to find consensus regarding difficult issues.

Idealistic Collaboration Proposition 3: Resilient domains have the greatest potential for being responsive to the domain level problem they were created to resolve.

This research was conducted as part a 33 month research programme. The nature of such a fixed duration prevented the research group from becoming a 'resilient domain'. Instead, the group took the form of a 'fad domain' (Gray, 2004), however, to avoid the impact of the research being short lived and unable to create lasting systems, two issues have emerged:

Firstly, a commercial focus was encouraged. This meant that the management practitioners were creating resilient domains internal to their own organisations. This has helped to maintain the momentum of energy into the topic of disruptive innovation within the participating organisations and has underpinned Case B's and Case D's decisions to internalise the DPM methodology and Case C's experimentation with further company assessments using the conceptual framework.

Secondly, a number of the participants, along with the author, were at the time of writing this thesis considering channels for further collaborative work.

Idealistic Collaboration Proposition 4: *Achieving integrative learning requires an assumption that an integrative outcome may be possible and acceptance of at least a small degree of risk to find out.*

The management practitioners who entered into this programme of research activities did so under the agreement that they did not know what would materialise – the bonding factor was an interest in the topic of new product/service development and the desire to better understand the

phenomenon of disruptive innovation. As the group consisted of non-competitive organisations the participants were keen to share their perspectives. This situation, combined with the fast emergence of high levels of social capital, ensured that there was no one member of the group who thought that they had an answer to the research problem that would be better than what we could achieved jointly as a team.